DEPARTMENT OF THE AIR FORCE

AIR UNIVERSITY

AIR FORCE INSTITUTE OF TECHNOLOGY

Wright-Patterson Air Force Base, Ohio

2

AFIT/GSM/LSY/87S-4

PRELIMINARY AND CRITICAL DESIGN REVIEW PROCEDURES AND EFFECTIVENESS

THESIS

Rodney Bennett
Captain, USAF

AFIT/GSM/LSY/87S-4

Approved for public release; distribution unlimited

The contents of the document are technically accurate, and no sensitive items, detrimental ideas, or deleterious information is contained therein. Furthermore, the views expressed in the document are those of the author and do not necessarily reflect the views of the School of Systems and Logistics, the Air University, the United States Air Force, or the Department of Defense.

AFIT/GSM/LSY/87S-4

PRELIMINARY AND CRITICAL DESIGN REVIEW PROCEDURES AND EFFECTIVENESS

THESIS

Presented to the Faculty of the School of Systems
and Logistics of the Air Force Institute of Technology
Air University
In Partial Fulfillment of the
Requirements for the Degree of
Master of Science in Logistics Management

Rodney Bennett, B.S.
Captain, USAF

September 1987

Acknowledgments

I would like to express my sincere appreciation to my sons, Nicholaus and Greg, who worked very long and hard hours stamping dates and return addresses on the surveys and return envelopes.

I especially want to thank my wife, Margaret, who helped in many ways from typing to providing me the motivation needed to complete this thesis.

Table of Contents

List of Tables

Abstract

This investigation examined the preparedness of Preliminary Design Review (PDR) and Critical Design Review (CDR) participants. Background and opinion data were gathered from junior and senior program managers and development engineers in order to assess their perception of PDR and CDR purposes, effectiveness/efficiencies, training and guidance.

The analysis was accomplished by sending a survey instrument to a sampling of program managers, and development engineers thoughout the Air Force population within the boarders of the U.S.A.

The respondents tended to be in agreement with the PDR/CDR purposes stated in Mil Std 1521B.

The analysis revealed that most PDR/CDRs are not as effective as ~~they~~ these could be. The primary reason is the lack of knowledge on what should be accomplished by the participants.

Most respondents claimed self teaching as the method of learning their preparation for PDR/CDRs. Over 86.2 percent of all respondents felt initial training would be useful and the majority indicated 6 to 12 months of acquisition. (Keywords: Thesis; Survey; questionnaires).

experience should be required before participating in a PDR/CDR. The most important guide for PDR/CDR preparation recommended by the respondents with previous PDR/CDR experience was the Mil Std 1521 and Defense System Management College (DSMC) System Engineering Management Guide.

PRELIMINARY AND CRITICAL DESIGN REVIEW PROCEDURES EFFECTIVENESS AND EFFICIENCY

I. Introduction

Each year the US Air Force spends millions of dollars on technical meetings. Government contractors spend a significant amount of time and money for the same.

These technical meetings range from Systems Requirements Reviews to Production Readiness Reviews. The two meetings of interest for this research are the Preliminary and Critical Design Reviews (PDR, CDR). These are the critical technical meetings that are held in the Full Scale Development (FSD) phase of an acquisition.

Basically, the technical meeting is a tool for evaluating and controlling an acquisition program. It allows the reviewers to focus their attention on the design process and allows them to review design concepts. Specifically, the PDR is concerned with reviewing the preliminary design against the system development specification, and the CDR is concerned with reviewing the detailed design against the draft product specification. The development process requires the preliminary design requirements be satisfied before the program begins its detailed design, and that the detailed design requirements be satisfied before a program enters into the fabrication process in the FSD phase.

The Military Standard Technical Reviews and Audits for Systems, Equipments, and Computer Programs (Mil Std 1521) defines the PDR operationally as:

> the review that shall be conducted for each Configuration Item (CI) or aggregate of CIs to: (1) evaluate the progress, technical adequacy, and risk resolution (on a technical, cost, and schedule basis) of the selected design approach, (2) determine its compatibility with performance and engineering speciality requirements of the CI development specification, (3) evaluate the degree of definition and assess the technical risk associated with the selected manufacturing methods/processes, and (4) establish the existence and compatibility of the physical and functional interfaces among the CI and other items of equipment, facilities, computer programs, and personnel(5:3).

> The CDR is defined operationaly as: the review that shall be conducted for each CI when the detailed design is essentially complete and its purposes are to: (1) determine that the detail design of the CI under review satisfies the performance and engineering speciality requirements of the CI development specifications, (2) establish the detail design compatibility among the CI and other items of equipment, facilities, computer programs and personnel, (3) assess CI risk areas (on a technical, cost, and schedule basis), (4) assess the results of the producibility analysis conducted on system hardware, and (5) review the preliminary product specifications (5:3).

The Mil Std 1521 is applicable to all technical reviews and audits and states that each review shall be conducted in accordance with its contents to the extent specified in program contract clauses, Statement of Work, and Contract Data Requirement List (5:1).

General Issue

The 1982 Defense Science Board Task Force on Transition from Development to Production, formed by the Undersecretary of Defense for Research and Engineering (USDRE), found as part of their review of problems within the acquisition process, that most reviews have a lack of direction and fail to achieve the main purposes of reviews, i.e.,to identify technical risks and challenge potentially inadequate system designs. In addition, most reviews are allotting more time for tutorials and system familiarization than for design problems. For the most part design reviews have become a time-consuming exercise contributing little to the assurance of design maturity (6: 4-18). The Defense Science Board Task Force report also stated, "In the acquisition process, first evidence of weapon systems problems usually becomes apparent when a program transitions from full-scale development into production." (6: 2-1). This transition point is within the time of Development Test and Evaluations of a system, and could be the first time design flaws not discovered during a PDR or CDR are revealed.

Mil Std 1521 provides for specific guidance on how to conduct design reviews; it outlines the tasks and responsibilities of both the contractor and the Air Force. The Mil Std 1521 describes procedures to be followed before, during and after each review session. It also establishes the appropriate time to schedule each type of review. Only after the successful completion and approval of these

critical reviews should a program enter into the next acquisition phase.

However, are these procedures being followed or are they adequate? This research addresses this question.

Specific Problem

Four specific problems with Preliminary and Critical Design Reviews were considered : 1) reviews are used more as tutorials and for familiarizing the Air Force attendees with the system hardware than for design problems, i.e. reviews often become a forum for providing an overview of the overall hardware design rather than an in- depth technical assessment of design maturity; 2) most Air Force attendees have not received sufficient prior training and have very limited prior experience in how to prepare for design reviews or how to conduct themselves at these review; 3) procedures of Mil Std 1521 are not being followed; 4) meetings are not efficient, i.e., action items opened and technical problems identified are minimal as compared to problems found after the conclusion of the design review.

Investigative Questions

The investigative questions are grouped into three major areas of concern for this research; Mil Standard 1521 PDR/CDR purposes, PDR/CDR effectiveness/efficiency, PDR/CDR training and guidance.

Mil Std 1521 PDR/CDR Purposes. The three investigative questions are as follows:

Question 1. Are acquisition program PDRs and CDRs conducted in accordance with the purposes stated in Mil Std 1521?

Question 2. Do program team members agree with the PDR/CDR purposes outlined in Mil Std 1521?

Question 3. Do PDR and CDR experienced individuals perceive The Mil Std 1521 PDR/CDR purposes to be of greater importance than do those without PDR/CDR experience?

PDR and CDR Effectiveness/Efficiency. The thirteen investigative questions are as follows:

Question 4. What approval was given at conclusion of the PDR and CDR?

Question 5. Did the PDR and CDR provide an adequate evaluation of the system to proceed into the next acquistion phase?

Question 6. Were all action items (AIs) resolved before the PDR/CDR approval was given?

Question 7. Were any AIs left open at the conclussion of the PDR and CDR?

Question 8. Of AIs presented at the PDR/CDR were any issued previously and were these closed prior to the PDR/CDR completion?

Question 9. Should all AIs be resolved before entering a PDR or CDR?

Question 10. Were there slippages in the system/subsystem design/development schedule and CDF schedule?

Question 11. Should the design be complete before approving a CDR?

Question 12. Were major design problems and modifications presented at the CDR and did any of these exist previously?

Question 13. Were the CDR supporting data packages effective in supporting the system review (i.e. complete, delivered on time)?

Question 14. Should there be a system overview or tutorial as part of a PDR and CDR; how much of a PDR/CDR should be devoted to system overview and tutorials?

Question 15. What correlations exist between an individual's opinion of the amount of system overview required to the amount conducted on the last PDR/CDR?

Question 16. Were AF participants were required to state their individual PDR/CDR objectives?

PDR and CDR Training and guidance. The four investigative questions are as follows:

Question 17. What type of PDR and CDR training and guidance have individual team member had?

Question 18. Would initial PDR/CDR training be useful?

Question 19. How much acquisition experience should an individual have before participating in a PDR or CDR?

Question 20. What is the single most useful guide for PDR and CDR procedural guidance?

II. Literature Review

Introduction

What is the perceived effectiveness of technical meetings held between the Department of Defense (DoD) component services and industry?

Each year DoD and industry spend large sums of money to conduct design reviews. However, the outcome of these reviews is not always perceived to be effective. However, the outcome of these reviews is not always perceived to be effective. In fact the Packard Commission (12: 66-67) report stated that each year billions of dollars are spent more or less efficiently.

Technical meetings or design reviews are used by the DoD component services as a means for evaluating the progress of a system's design and development.

This literature review present the findings of a literature search on technical meetings and design reviews. This review focuses on the Air Force and industry comments of meeting purposes, objectives, procedures and problems.

Definition

A design review is a formal, completely documented and systematic study of the actual status of a design, as opposed to its forecast status, together with a definition of the next steps to be taken. According to Kitagawa

(18: 212), "A design review is an effective method for improving the reliability of a product, decreasing the cost and reducing the development time." The System Program Office/Engineering Handbook (1: 56) states, "Technical meetings are the bread and butter of a successful program." In contrast, as to what a technical meeting is, the Defense System Management College (DSMC), System Engineering Management Guide (SEMG) (3: 13-9) states,"Design reviews are not tutorials."

Justification of the Search and Review

The justification of this research is to ensure that each participant at a review has a complete understanding of what is required of himself, and to identify lessons learned, so that the Air Force gets maximum productivity per dollars spent to conduct a review.

Discussions

Description. All design and development is some form of compromise between conflicting requirements. These conflicts create the necessity to examine performance characteristics, reliabilitiy, and maintainability of a design, and to relate each to the other and to whole-life-cost (13:16).

Design reviews are repetitive activitities and are to provide a representative evaluation of the on going design

to management and anyone else involved in the project. These reviews should analyze the status of the development and decide future action (13:16).

Kitagawa (18:212) states:

> One distinguishing feature of the design review is its capability to make positive use of the technical knowledge, experience, and information possessed by specialists.
>
> If there is an inadequate understanding of design by the reviewer, it will be impossible for him to demonstrate his specialized knowledge and, if this occurs, the design review will not produce good results. So it is necessary to have broad knowledge and valuable information that can be of use in a design review (18:212).

Parnas and Clements (11:252) made the following comment about reviews:

> We can compare the projects' achievements to those that the ideal process calls for. We can identify areas in which we are behind (or ahead). Regular review of the project's progress by outsiders is essential to good management. If the project is attempting to follow a standard process, it will be easier to review.

Objectives. Some objectives of technical meetings and design reviews are:

> 1) confirm that designs meet requirements, 2) uncover any hidden design flaws, 3) reduce the variety of solutions by selection, 4) foster standarization of equipment and procedures, 5) ensure that the design can be produced within acceptable tolerances and can be controlled within specification, 6) establish and maintain communications across interfaces, 7)focus all activities on a common goal, and 8)speed up development (13:21).

Design reviews are conducted within stages or phases of overall programs. In industry there are three stages of

review: 1) first stage, the preliminary review--held at times of product concept studies, 2) second stage, the intermediate reviews-held at previously fixed decision points, 3) third stage, the final review-held just before full production commences (13:21). These stages correlate with the Air Force Reviews as defined in the DSMC SEMG (3:13-7); 1) the System Requirement Review is held at the beginning of a program startup, 2) the System Design Reviews are held at pre-established time intervals, 3) the final review of a design phase is held at the end of the full scale development phase, just prior to releasing the design to production go-ahead (3:13-7).

Purpose. Design reviews should be used to evaluate trade offs between performance, cost, schedule and supportability. In addition, design reviews allow the Government to overview the complete system design and evaluate its capability to satisfy total mission requirements. The design review is to search out design weaknesses or faulty designs (3:13-6). The cost of any engineering design changes, especially in the later stages of a program, are usually very large. It is imperative, in particularly large programs, that formalized design reviews be established early (13:21).

The major purpose of a technical meeting is to review engineering design progress toward the final design specification (13:21).

The general purposes of PDR's and CDR's are described in AFR 800-14 and AFSCP 800-3. These documents refer to the Mil Std 1521 for specific detailed procedures a program should follow for PDR and CDR.

In general, the purpose of a PDR is to evaluate the design concepts the contractor intends to use for each CI to meet the allocated baseline requirements. The purpose of a CDR is to evaluate the detailed design (drawing, flow charts) of each CI to see if it will be able to achieve the allocated baseline requirements (15:214). A successful PDR is required for each CI prior to proceeding into detail design (4:4-4). The contractor starts detail design control with CDR (15:214).

> The Air Force Regulation 800-14 stresses the requirement for technical control, technical task required to progress from an operational need or requirement to the development and operation of the system by the user. Formal technical control is accomplished by technical reviews at discrete milestones (4:4-3).
>
> The completeness of the reviews provide the basis for rendering decisions furthering the course of the program to ensure that the system design integrity is maintained, technical deficiencies are isolated, and necessary changes are identified promptly with formal technical reviews procedures specifically detailed in MIL-STD-499A (USAF) and MIL-STD-1521 (USAF) (4:4-3).

In addition to the requirements outlined in AFR 800-14 the Air Force Systems Command Pamphlet 800-3 (AFSCP 800-3) describes the purposes of technical meetings as to review the integrated engineering and technical deviation of engineering efforts periodically to determine the technical

adequacy of contractor efforts in meeting system requirements (9:8-4).

AFSCP 800-3 (9:8-4.5) outlines some of the major items to consider when planning, conducting, or participating in formal reviews as:

a. Assigning contractually binding action items for disposition of non conformances identified.
b. Availability of detailed documentation to assess contractor progress in developing specifications.
c. Reviewing engineering documentation to ensure that it facilitates synthesis and integration of intrasystem items.
d. Understanding the types of decisions that can be used to establish the adequacy and accuracy of the design review.
    (1) Unqualified approval - specify complete agreement.
    (2) Approval w/contingent action items - used when the review is not considered accomplished until satisfactory completion of actions.
    (3) Approval with deviation - used when it is in the interest of the program to award limited approval and protect program schedules pending completion of future engineering as indication by action items.
    (4) Disapproval - used when review is unsatisfactory or generally inadequate. A new review must be conducted as a result of disapproval.

The personnel to participate in design reviews should possess program expertise. The same personnel should participate in reviews throughout the acquisition process. This ensures consistent technical expertise in evaluating contractor engineering efforts.

Using and supporting commands should participate to assist the program office but not give specific direction.

Deficiencies should be isolated at the earliest point in time, and necessary changes should be identified promptly (AFSC 8.5).

AFSCP 800-3 states a successful PDR is required before each CI can procede into the detailed design; and the successful completion of CDR is required for each CI before commitment of the design to production (9:8.5).

Procedures. Some initial procedures to follow prior to and during meetings are: 1) Identify problems early from the data package submission and attempts made to clarify them on an individual basis; 2) Avoid presenting major problem surprises (3:13-9); 3) Establish routine communication channels with the contractor; 4) Have effective meetings frequent enough to have a greater probability of uncovering design errors; 5) Have the backing of top-level management; 6) Have the necessary data available in order to have a quality review (8:70); 7) Work the meeting agenda (16:10); 8) Motivate participants before the start of meetings, in terms of commitments and ask participants to verbalize their plans for the meeting.

The supporting data packages should be received from the contractor and reviewed before the meeting. This data package should contain applicable engineering drawings, specifications and reports. According to Kitagawa (10:214), "Good use of data packages could point out more than 30% of product failures due to misdesign." Agenda Items which may

meet with controversy or objections should be placed at the end of a long agenda of a meeting to ensure other items will get their appropriate coverage. With motivated participants the result should be a better quality performance of reviewers (16:9).

Some recommended procedures for technical meetings are as follows:

1. Meetings should be held at the contractor facility to ensure the technical experts required will be available.

2. At the end of each meeting day personnel should caucus to evaluate action items. Decisions, agreements, and approved action items should be recorded and signed by both the Government and the contractor at the end of each day. Each action item should be assigned two responsible individuals (one Govenment, one contractor) and required to respond by an established date in order to close the action item (3:13-9).

3. At the conclusion of the review a summary of action items taken should be prepared for presentation. Issues, questions, agreements, and action items must be documented in minutes and assigned, tracked, and coordinated with appropriate participants through the close out or completion of the action item (3:13-8).

4. Evaluate precisely and in detail to find the influences of over-designed or manufacturing to close tolerances at high cost. Determine if the cost provides significantly better performance and reliability (QA/RM:17).

In addition Welsch (17:59) states,

> "All designs should be reviewed by qualified reviewers and time and resources should be made available to do thorough reviews. If not, the project management could be forced to take the time and spend 10 or 100 times the money if problems surface during construction 'pay me now or pay me later'."

In controlling changes the acquisition team should always ask the question, "Is the change really necessary?" "What are the consequences if the change is not made?"

These changes should not be allowed to accumulate. If the contractor does not cooperate with timely proposals, his right to proceeds with that portion of the work can be withdrawn just long enough to get his attention and no longer (17:59).

Also, the team size should be held to a minimum number of participants to adequately cover the areas of the review so that excessive time is not used in dialogue between attendees (3:13-9). It is important to ensure the review team leader is an experienced member, experienced in research and development, for the given stage of a project. Then in the manufacturing stage he should be replaced by a production manager. This provides the proper experience at the appropriate stage of the program (13:21).

Both AFR 800-14 and AFSCP 800-3 refer to the Mil Std 1521 for the specific details of the contractor's and procuring activity's role in technical meetings.

The contractor is responsible for establishing the time, place and agenda in accordance with the master

milestone schedule, subject to procuring activity coordination. It should be accomplished sufficiently in advance to allow for adequate preparation for the meeting.

In addition, the contractor should prepare for each review in sufficient detail consistent with the scope and magnitude of the review; designate a co-chairperson for each; record minutes consisting of significant questions and answers, action items, deviations, conclusions and recommended courses of action resulting from presentations or discussions. Recommendations not accepted should also be recorded together with the reason for non-acceptance. All action items should be clearly recorded in the minutes and identify whether procurring activity and/or contractor action is required for the resolutions (5:6).

Contractor shall be required to provide the necessary resources and material to perform the review effectively (5:5).

Procurring activity role is to review the minutes (daily) and ensure these reflect all significant procuring activity inputs. Provide formal acknowledgement to the contractor of the accomplishment of each review by notifying the contractor of:

Approval - indicate review was satisfactorily completed.

Contingent approval - indicate the review is not considered accomplished until the satisfactory completion of resultant action items.

Disapproval - indicate that the review was seriously inadequate (5:7).

Problems. The major problem is there are no formally established methods on how to structure or conduct technical meetings (ASD:56). In addition, many of the Air Force review team leaders are inexperienced in the best approaches to conducting technical meetings.

In the past it was easy to overlook important design problems in the design planning stage, and major design modifications were often done during the detailed design stage. This practice led to design flaws, cost and schedule problems (10:212).

Formal reviews, conducted through a committee, consist of representatives from engineering, marketing, manufacturing, quality control, and purchasing. This team make-up led to the reviewers sometimes adopting the view that the design reviews' function is to veto designs rather than to provide information and ideas for improving the designs (2:96).

Meetings held too frequently can cause the contractor to spend a great deal of time preparing for meetings at the expense of doing the actual work (1:56).

Some specific examples of problems encountered in industry directly attributed to a lack of good design review practices are as follows:

1. An audit of construction change orders disclosed that 936 out of 2,035 (46%) of the

construction change orders reviewed involving $67.4 million (17:57-58).

2. The cost of six projects for construction of air traffic control tower facilities increased by more than $760,000 (17:58).

3. Total manhours of the data packages were 5-10% of the total design manhours and the manhours of the meetings were 10-50% the total review manhours (10:213).

4. A change order for $7 million to clean, repair and repaint 16 fuel storage tanks (17:50).

5. Studies show that upwards of 55% of all software errors are introduced in the early [Requirements Definition] phase but only 15% of those errors were found and corrected by the end of this phase (7:42).

6. Operations and maintenance software costs for a system with an expected useful life of 8 to 20 years will amount to 250 to 500% of the development costs; of that amount, only about 15% goes into correcting the modifications to meet new, or missed requirements (7:47).

Some additional, more general, problems with reviews are:

1. The number of design review meetings and the total manhours devoted to a review were of little importance, but the level of technology was of great importance. In other words, the products for which reviews were very effective were most often those for which concrete objectives had been set, for which preparation had been made. Products for which reviews were not very effective were most often those for which level objectives and level predictions could not be adequately established because the necessary information and data were unavailable (10:214).

2. If the data packages which serve to clarify the design process were not available at the design stage, design review would not always contribute to the reduction of design changes after release of the design to manufacturing (10:212).

The results of design reviews are evaluated based on number of established action items, frequency of design changes and past review investigations (10:213).

The Defense Science Board Task Force (6:16:4.8-4.9) describes four traps that a review can have and the benefits if the best design review practices are followed and the

consequence if not followed. These steps, benefits and consequences are:

1. When program review formats and

   "Best" practices are used:
   technical balance can be maintained between management and design.

   or "Current" practices are used:
   reviews over staffed with management personnel and management status is reviewed.

2. When the review is keyed to program milestones and

   "Best" practices are used:
   design maturity can be determined

   or "Current" practices are used:
   reviews are success-oriented, not a technical evaluation. Risk is not identified or assessed and design deficiencies are not identified.

3. When the review is focused on the design and

   "Best" practices are used:
   the design will fullfill all specified requirements.

   or "Current" practices are used:
   analyses, assumptions, and processes are not reviewed; trade-off studies, underlying data, and risk assessments are not presented. Thus, design is not influenced by all analytical activities.

4. When design reviews are held informally and

   "Best" practice are used:
   design baselines can be certified.

   or "Current" practices are used:
   design review actions are not reported to management and a formal report with appropriate action items is not prepared. So, total system requirements are not met (6:4.8-9).

SUMMARY

Reviews are important, especically the Preliminary and Critical Design Reviews. These are the most significant reviews of an acquisition program. However, if these reviews are not conducted in a structured format with specific procedures and the participation of appropriately trained and experienced personnel, the time and money expended by the Air Force and the contractor could be considered wasted. In addition, the end item delivered could very easily exceed original cost and delivery schedule and still not meet the minimum design requirements established at the beginning of a program.

III. Methodology

Introduction

This chapter describes the methodology used to collect and analyze the data required to answer all the investigation questions posed. The data collection instrument will be discussed followed by discussions on sample population, sample plan, data analysis, assumptions and limitations.

Data Collection Instrument

A mail survey was used to gather background information and opinion data necessary to complete this research (Appendix A).

The survey measures perceptions and attitudes toward PDR and CDR effectiveness in evaluating system design and development progress. It questioned if established Air Force standard procedures are being followed and how effective these are perceived by Air Force program managers and development engineers. The survey was designed to gather sufficient data to determine if perceived purposes of PDRs and CDRs correlate to purposes satisfied on the individual's most current program. The data was analyzed and evaluated to determine PDR and CDR effectiveness, and to determine whether or not there is a need for improved PDR and CDR

procedure guidance. The survey instrument was conducted in May to June 1987.

The first nine questions of the survey provide background data for each of the individual respondents.

Questions 10 through 14 provide the respondents opinions on agreement with the purposes of PDR outlined in Mil Standard 1521.

Questions 17 through 22 provide the respondents opinion on agreement with the purposes of CDR outlined in Mil Standard 1521.

Questions 25 through 29 provide the respondents perception of how well the Mil Std 1521 PDR purposes of the last PDR he attended were satisfied.

Questions 33 through 37 provided the respondents perception of how well the Mil Std 1521 CDR purposes of the last CDR he attended were satisfied.

Questions 14,16,24,30,38 provided the respondents opinion on system overview and tutorial as these relate to purposes of PDR and CDR.

Questions 43,49 and 53 through 54 provide the respondents opinion on PDR and CDR guidance and training.

The survey questions are summarized in Table 1 and matched to the specific investigative questions.

TABLE 1

Survey Structure

Investigative Question	Survey Question	Area of Concern
1	25-29 (PDR) 33-37 (CDR)	Mil Std 1521 PDR/CDR Purposes
2	10-13 (PDR) 17-22 (CDR)	
3	6, 10-13 (PDR) 6, 17-22 (CDR)	
4	32,41	PDR/CDR Effectiveness/Efficiency
5	6, 56	
6	31, 39	
7	45	
8	46, 47	
9	6, 9, 15 (PDR) 6, 9, 23 (CDR)	
10	44, 52	
11	6, 9, 42	
12	40, 48	
13	50, 51	
14	6, 9, 16 (PDR) 6, 9, 24 (CDR)	
15	14, 30 (PDR) 12, 38 (CDR)	
16	49	

Table 1 Continued

17	9, 43	PDR/CDR Training and Guidance
18	9, 53	
19	6, 9, 54	
20	9, 55	

Sample Population

The population included all active duty Air Force officers stationed within the contintent of the United States of America with a grade from O-2 to O-5 who are currently holding Duty Air Force Speciality Code identifiers of 2716, 2724 (Acquisition Management poitions) and 2816, 28X5 (Development Engineering positions).

Based on personnel manpower listings provided by, there are currently 614 officers with a DAFSC of 2716, 921 officers with a DAFSC of 2724, 776 officers with a DAFSC of 2816 and 3243 officers with a DAFSC of 28X5. Table 2 shows the population size for each subgroup. The table data was generated from an Atlas Data Base Statistic Inquiry on 15 April 1987.

A 92.5 percent confidence level was selected for this research. A simple random sampling was used in selecting sampling subgroups. The subgroups matrix the four DAFSC (2716,2724,2816 and 28X5) by ranks (O-2,O-3,O-4 and O-5).

TABLE 2
Rank by DAFSC Matrix

RANK	DAFSC 2716	2724	2816	28X5
O-5	371	--	351	--
O-4	238	38	424	207
O-3	5	462	1	1608
O-2	--	421	--	1428
Total	614	921	776	3243

The following formula was used to determine the sample size necessary for each subgroup to meet the desired confidence level of 92.5 percent:

$$n = [N(z^2)*p(1-p)]/[(n-1)*(d^2)+(z^2)*p(1-p)] \quad \text{(eq. 1)}$$

where: n = sample size

N = population size from each subgroup

P = maximum sample size factor (.50)

D = desired tolerance (.075)

Z = factor of assurance (1.44) for 92.5 percent confidence level

Only company grade officers (O-2 to O-3) were entered in the data base for company grade DAFSCs of 2724 and 28X5, and only, field grade officers (O-4 to O-5) were entered in the data base for the field grade DAFSCs of 2716 and 2816.

The sample size necessary from each subgroup to meet the 92.5 percent confidence level was 57 O-4s, 88 O-5s (DAFSC 2716), 70 O-2s, 76 O-3s (DAFSC 2724), 82 O-4s, 68 O-5s (DAFSC 2816) and 72 O-2s, 81 O-3s (DAFSC 28X5).

Data Analysis

SAS statistical package was used to analyze data where appropriate. Frequencies and percentages of each response were calculated for each survey question. Crosstabulations of the numbers and percentages of each possible response to each survey question were calculated for each of the sample population subgroups.

Chi-squared test of categorical data involves taking a sample from a single population and classifying each individual with respect to two different categorical factors (such as religious preference and political party registraion). The null hypothesis in this situation is that the two factors are independent.

The critical value to test against is dependent upon the degrees of freedom and the selected alpha value.

For this research an alpha value of 0.075 was selected to be consistent with the research confidence level of 92.5 percent.

The SAS program provided chi square probability values for each of the cross tabulatioin tables. A computed chi square probability value smaller than 0.075 indicates the two factors are not independent of each other.

The chi-square test was used with investigative question 10.

SAS Proc Corr was used to compute the correlation factor. Previous studies, as discussed in the AFIT ORSC 542 class, Management and Behavior in Organizations, have indicated a correlation factor of 0.25 is good when addressing opinions and attitudes of people. A correlation factor of 0.4 is very good and 0.38 or greater is significant (14).

The results of the frequency tabulations, chi-square goodness of fit test, correlations and crosstabulations that correspond to investigative questions are presented in chapter four.

Assumptions and Limitations

Assumptions. This research assumed that the respondends answered all questions accurately and that their own attitudes, opinions and perceptions are reliable and valid.

Limitations. No attempt has been made to generalize the results Air Force wide. A large part of any PDR and CDR participant population include, not only Air Force military, but the civil service work force. This large population (Civil Service) was not surveyed due to the time required for civil service survey approval.

Before any generalization could be made response data from civil service program managers and development engineers carreer fields would have to be included.

Other limitations concern the accuracy involved in measuring attitudes, opinions and perceptions.

Summary

This chapter described the methodolgy that was used in this research project. Chapter four discusses the results of this research and chapter five summarizes the findings and provides recommendations.

IV. Findings and Analysis of Data

Introduction

This chapter provides the results of the survey in answering the investigative questions. The results are presented in tabular form and represent frequency of response to each question. Addressing some of the investigation questions involved compiling and analyzing data on more than one survey question.

Survey Response Rates. Tables 3.a and 3.b contain a summary of the number and percentage of responsdents to the survey.

TABLE 3.a
Frequency of Response
by DAFSC Against Rank

	DAFSC			
	2716	2724	2816	28X5
Rank				
LtCol	31	--	15	--
Maj	24	--	15	--
Capt	--	24	--	83
1Lt	--	24	--	44

TABLE 3.b
Percentage of Response
by DAFSC Against Rank

	DAFSC			
	2716	2724	2816	28X5
Rank				
LtCol	41.9	--	28.8	--
Maj	50.0	--	23.8	--
Capt	--	34.8	--	34.6
1Lt	--	38.1	--	31.0

The response rate to the survey questionaire were poorer than expected. The survey questionaire was sent to 790 individuals with only 271 returned. The 92.5 percent confidence level set for this research could not be supported in the subgroups with the exceptions of the DAFSC 28X5 O-3 and O-2 subgroups.

The subgroups could support a greater than 85 and less than 90 percent confidence level. Three subgroups were eliminated from the analysis, DAFSC 2716 O-3s, DAFSC 2724 O-4s, DAFSC 28X5 O-4s. DAFSC 2716 and 2816 are field grade positions and are normally supported with field grade ranks of O-4 and O-5; O-3 would be unusual. DAFSC 2724 and 28X5 are company grade positions and normally support the company gade ranks of O-1, O-2 and O-3; O-4 would be unusual.

This section will address each category of survey question. There are four categories of survey questions consisting of Background information, Mil Standard 1521

PDR/CDR purposes, PDR/CDR effectiveness/efficiency measures and PDR/CDR training and guidance. The format for all findings and analysis of data pertaining to the investigative questions is presented in this section as follows:

1). Investigative question

2). Discussion

3). Findings

Background Information

Tables 4 through 9 cover the category of background information.

Table 4 shows the percentage of total respondents by rank. Over 40 percent were of the rank of O-3.

TABLE 4
Current Military Rank

Rank	# of Respondents	% of Respondents
LtCol	45	17.5
Maj	40	15.5
Capt	104	40.5
1Lt	68	26.5
Total	257	100.0

Table 5 shows the acquisition phase the respondents were most familiar with. Forty-nine percent were most familiar with Full Scale Development phase of acquisition.

TABLE 5
Acquisition Phase Most Familiar

Phase	# of Respondents	% of Respondents
Concept Exporation	27	10.8
Demonstration/Validation	64	25.5
Full Scale Development	124	49.4
Production	36	14.3
Total	251	100.0

Table 6 shows the number of years of acquisition experience the respondents have. Thirty-three percent of the respondents claimed 3-4 years experience. Eighty-six percent of the respondents had experience ranging from 0 to 10 years.

TABLE 6
Years of Acquisition Experience

Years	# of Respondents	% of Respondents
0 - 2	55	21.4
3 - 4	85	33.1
5 - 7	53	20.6
8 - 10	29	11.3
11 - 14	15	5.8
> 15	20	7.8
Total	257	100.0

Table 7 shows the respondents area of education. The results revealed three main areas, 51.2 percent held a technical bachelors degree, 22.7 percent held a technical masters degree and 21.0 percent held a non technical masters degree.

TABLE 7
Education Area

Degree Area	# of Respondents	% of Respondents
Technical Bachelors	135	51.2
Non Technical Bachelors	10	4.0
Technical Masters	57	22.7
Non Technical Masters	53	21.0
Technical Doctoral	3	1.2
Total	252	100.1

Table 8 shows the Duty Air Force Specialty Code (DAFSC) identifier of each repondent. Thirty-two percent were field grade (2716,2816) and 66.8 percent were company grade (2724,28X5) positions. Thirty-seven percent were project managers (2716, 2724) and 62.5 percent were development engineers (2816,28X5). The largest DAFSC group consist of 28X5 for 47.7 percent of the respondents.

TABLE 8
Duty AF Specialty Code

DAFSC	# of Respondents	% of Respondents
2716	46	18.0
2816	38	14.8
2724	49	19.1
28X5	122	47.7
Total	255	99.6

Table 9 shows the percentage of all respondents having participated in PDRs and CDRs against their DAFSC. The range of participation was 0 to 50 for PDRs and CDRs. Seventy-four percent of all respondents had participated in a PDR and 72.4 percent had participated in a CDR.

TABLE 9
PDR/CDR by DAFSC Participation Matrix (in %)

DAFSC	PDR	CDR
2716	78.26	73.91
2816	80.56	80.56
2724	68.03	68.75
28X5	67.75	68.85

Military Standard 1521 PDR/CDR Purposes

Tables 18 through 39 covers the category of Mil Standard 1521 PDR/CDR purposes.

Investigative questions one through three posed in chapter one are addressed here.

Investigative Question 1a. Are acquisition program PDRs conducted in accordance with the purposes stated in Mil Std 1521?

Discussion. Survey questions 25 through 29 were the stated purposes of a PDR outlined from Mil Std 1521. The questions were phrased to gain the repondents opinion on whether these PDR purposes were satisfied on the last PDR the individual attended.

Survey Question 25:

The review adequately covered the technical adequacy of the selected design approach.

Survey Question 26:

The review adequately covered the risk resolution (on a technical, cost, and schedule basis) of the selected design approach.

Survey Question 27:

The review adequately covered the design approach capability in meeting the performance and engineering specialty requirements of the CI development specification.

Survey Question 28:

The review adequately covered the technical risk associated with selected manufacturing methods and processes.

Survey Question 29:

The review adequately covered the physical and functional interfaces among the CI and other equipment, facilities, computer programs, and personnel.

Findings. Seventy-eight percent of all respondents range in agreement from moderate to strong with the stated purpose of survey question 25.

Fifty-one percent of all respondents range in agreement from moderate to strong with the stated purpose of survey question 26.

Sixty-one percent of all respondents range in agreement from moderate to strong with the stated purpose of survey question 27.

Only 37.5 percent of all respondents range in agreement from moderate to strong with the stated purpose of survey question 28, 30.4 percent neither agreed nor disagreed and 32.1 percent, moderate to strongly disagreed.

Slightly over half, 52.2 percent, range in agreement from moderate to strong with the stated purposes of survey question 29.

TABLE 10
Survey Question 25: Last PDR Technical Adequacy

Response	# of Respondents	% of Respondents
Strongly Agree	33	18.0
Moderately Agree	111	60.7
Neither Agree or Disagree	13	7.1
Moderately Disagree	23	12.6
Strongly Disagree	3	1.6
Total	183	100.0

TABLE 11
Survey Question 26: Last PDR Risk Resolution

Response	# of Respondents	% of Respondents
Strongly Agree	14	7.7
Moderately Agree	81	44.3
Neither Agree or Disagree	31	16.9
Moderately Disagree	50	27.3
Strongly Disagree	7	3.8
Total	183	100.0

TABLE 12
Survey Question 27: Last PDR Design Approach

Response	# of Respondents	% of Respondents
Strongly Agree	22	12.1
Moderately Agree	90	49.5
Neither Agree or Disagree	33	18.1
Moderately Disagree	32	17.6
Strongly Disagree	5	2.7
Total	182	100.0

TABLE 13
Survey Question 28: Last PDR Technical Risk

Response	# of Respondents	% of Respondents
Strongly Agree	8	4.4
Moderately Agree	60	33.1
Neither Agree or Disagree	55	30.4
Moderately Disagree	49	27.1
Strongly Disagree	9	5.0
Total	181	100.0

TABLE 14
Survey Question 29: Last PDR Interfaces

Response	# of Respondents	% of Respondents
Strongly Agree	11	6.0
Moderately Agree	84	46.2
Neither Agree or Disagree	33	18.1
Moderately Disagree	44	24.2
Strongly Disagree	10	5.5
Total	182	100.0

Investigative Question 1b. Are acquisition program CDRs conducted in accordance with the purposes stated in Mil Std 1521?

Discussion. Survey questions 33 through 37 were the stated purposes of a CDR outlined from Mil Std 1521. The questions were phrased to gain the repondents opinion on whether these CDR purposes were satisfied on the last CDR the individual attended.

Survey Question 33:

> The review adequately determined that the configuration item under review satisfied the performance and engineering specialty requirements of the CI development specification.

Survey Question 34:

> The review adequately determined that the detailed design was compatible between the CI and the other items of equipment, facilities, and computer programs.

Survey Question 35:

The review adequately assessed the CI risk areas (on a technical, cost and schedule basis).

Survey Question 36:

The review adequately assessed the producibility of the system hardware design.

Survey Question 37:

The review adequately covered the preliminary product specification.

Findings. Seventy-eight percent indicated moderate to strong agreement with the stated purposes of survey question 33 to having been satisfied at their last CDR.

Seventy-two percent indicated moderate to strong agreement with the stated purposes of survey question 34 having been satisfied.

Sixty percent indicated moderate to strong agreement swith the stated purposes of survey question 35 having been satisfied. Survey questions 36 and 37 were exceptions.

Only 48 percent of all the respndents moderately to strongly agreed with the stated purpose of survey question 36 having been satisfied.

Slightly over half, 52.8 percent, of all respondents moderately to strongly agreed with the stated purpose of survey question 37 having been satisfied.

TABLE 15
Survey Question 33: Last CDR Performance Requirements

Response	# of Respondents	% of Respondents
Strongly Agree	34	19.1
Moderately Agree	105	59.0
Neither Agree or Disagree	18	10.1
Moderately Disagree	19	10.7
Strongly Disagree	2	1.1
Total	178	100.0

TABLE 16
Survey Question 34: Last CDR Design Compatibility

Response	# of Respondents	% of Respondents
Strongly Agree	23	13.0
Moderately Agree	105	59.3
Neither Agree or Disagree	16	9.0
Moderately Disagree	31	17.5
Strongly Disagree	2	1.1
Total	177	100.0

TABLE 17
Survey Question 35: Last CDR Technical Risk

Response	# of Respondents	% of Respondents
Strongly Agree	22	12.4
Moderately Agree	85	48.0
Neither Agree or Disagree	37	20.9
Moderately Disagree	28	15.8
Strongly Disagree	5	2.8
Total	177	100.0

TABLE 18
Survey Question 36: Last CDR Producibility

Response	# of Respondents	% of Respondents
Strongly Agree	17	9.7
Moderately Agree	67	38.3
Neither Agree or Disagree	51	29.1
Moderately Disagree	36	20.6
Strongly Disagree	4	2.3
Total	175	100.0

TABLE 19
Survey Question 37: Last CDR Product Specification

Response	# of Respondents	% of Respondents
Strongly Agree	17	9.7
Moderately Agree	76	43.2
Neither Agree or Disagree	41	23.3
Moderately Disagree	35	19.9
Strongly Disagree	7	4.0
Total	176	100.0

Investigative Question 2a. Do progam team members agree with the PDR purposes outlined in Mil Std 1521?

Discussion. Survey questions 10 through 13 were the stated purposes of a PDR in Mil Std 1521. The questions were phrased to get the respondents opinion as to whether these are PDR purposes.

Survey Question 10:

To evaluate the progress, technical adequacy, and risk resolution (on a technical, cost and schedule basis) of the selected design approach.

Survey Question 11:

To determine the design approach compatibility with performance and engineering specialty requirements of the Configuration Item (CI) development specification.

Survey Question 12:

To assess the technical risk associated with the selected manufacturing methods/processes.

Survey Question 13:

To define the physical and functional interfaces among the CI and other items of equipment, facilities, computer programs, and personnel.

Findings. Eighty-nine percent indicated moderate to strong agreement with the stated PDR purposes of the survey question 10.

Eighty percent indicated moderate to strong agreement with the stated PDR purposes of the survey question 11.

Fifty-three percent indicated moderate to strong agreement with the stated PDR purposes of the survey question 12.

Sixty-five percent indicated moderate to strong agreement with the stated PDR purposes of the survey question 13.

TABLE 20
Survey Question 10: PDR Technical Adequacy

Response	# of Respondents	% of Respondents
Strongly Agree	105	42.2
Moderately Agree	118	47.4
Neither Agree or Disagree	12	4.8
Moderately Disagree	12	4.8
Strongly Disagree	2	0.8
Total	249	100.0

TABLE 21
Survey Question 11: PDR Design Approach

Response	# of Respondents	% of Respondents
Strongly Agree	86	34.4
Moderately Agree	115	46.0
Neither Agree or Disagree	35	14.0
Moderately Disagree	14	5.6
Total	250	100.0

TABLE 22
Survey Question 12: PDR Technical Risk

Response	# of Respondents	% of Respondents
Strongly Agree	35	14.0
Moderately Agree	99	39.6
Neither Agree or Disagree	57	22.8
Moderately Disagree	47	18.8
Strongly Disagree	12	4.8
Total	250	100.0

TABLE 23
Survey Question 13: PDR Interfaces

Response	# of Respondents	% of Respondents
Strongly Agree	57	23.1
Moderately Agree	104	42.1
Neither Agree or Disagree	42	17.0
Moderately Disagree	34	13.8
Strongly Disagree	10	4.0
Total	247	100.0

Investigative Question 2b. Do program team members agree with the CDR purposes outlined in Mil Std 1521?

Discussion. Survey questions 17 through 22 were the stated purposes of a CDR in Mil Std 1521. The questions were phrased to get the respondents opinion as to whether these are CDR purposes.

Survey Question 17:

To determine that the detailed design of the configuration item under review satisfies the performance and engineering specialty requirements of the CI development specifications.

Survey Question 18:

To establish the detail design compatibility among the CI and other items of equipment, facilities, computer programs.

Survey Question 19:

To assess the configuration item risk areas (on a technical, cost and schedule basis).

Survey Question 20:

To assess the results of the producibility analyses conducted on system hardware design.

Survey Question 21:

To review the preliminary product specification.

Survey Question 22:

To review major design modifications.

Findings. The trend for the respondents was 96, 90.4, 78, 66.9, 54.8 and 59.8 percent for survey questions 17, 18, 19, 20, 21, and 22 respectively, indicating moderate to strong agreement with the stated CDR purposes of the survey questions.

TABLE 24
Survey Question 17: CDR Performance Requirements

Response	# of Respondents	% of Respondents
Strongly Agree	150	60.0
Moderately Agree	90	36.0
Neither Agree or Disagree	5	2.0
Moderately Disagree	5	2.0
Total	250	100.0

TABLE 25
Survey Question 18: CDR Design Compatibility

Response	# of Respondents	% of Respondents
Strongly Agree	105	42.0
Moderately Agree	121	48.4
Neither Agree or Disagree	10	4.0
Moderately Disagree	12	4.8
Strongly Disagree	2	0.8
Total	250	100.0

TABLE 26
Survey Question 19: CDR Risk Resolution

Response	# of Respondents	% of Respondents
Strongly Agree	57	22.8
Moderately Agree	138	55.2
Neither Agree or Disagree	31	12.4
Moderately Disagree	20	8.0
Strongly Disagree	4	1.6
Total	250	100.0

TABLE 27
Survey Question 20: CDR Producibility

Response	# of Respondents	% of Respondents
Strongly Agree	41	16.7
Moderately Agree	123	50.2
Neither Agree or Disagree	57	23.2
Moderately Disagree	21	8.6
Strongly Disagree	3	1.2
Total	245	100.0

TABLE 28
Survey Question 21: CDR Product Specification

Response	# of Respondents	% of Respondents
Strongly Agree	33	13.3
Moderately Agree	103	41.5
Neither Agree or Disagree	49	19.8
Moderately Disagree	48	19.4
Strongly Disagree	15	6.0
Total	248	100.0

TABLE 29
Survey Question 22: CDR Design Modifications

Response	# of Respondents	% of Respondents
Strongly Agree	63	25.3
Moderately Agree	86	34.5
Neither Agree or Disagree	29	11.6
Moderately Disagree	55	22.1
Strongly Disagree	16	6.4
Total	249	100.0

Investigative Question 3a. Do experienced PDR individuals perceive the Mil Std 1521 PDR purposes to be of greater importance than do those without PDR experience?

Discussion. Survey questions 6 and 10 through 13 was used to address this investigative question. This question addressed how useful the Mil Std is to managers and engineers by examining the separate opinions of those respondents that have and have not participated in a PDR.

The cross tabulation was used to examine the relationship of the responses to survey questions 10 through 13 against the PDR experience variable.

Survey Question 6:

Number of Preliminary Design Reviews you have formally participated in.

Survey Question 10:

To evaluate the progress, technical adequacy, and risk resolution (on a technical, cost and schedule basis) of the selected design approach.

Survey Question 11:

To determine the design approach compatibility with performance and engineering specialty requirements of the Configuration Item (CI) development specification.

Survey Question 12:

To assess the technical risk associated with the selected manufacturing methods/processes.

Survey Question 13:

To define the physical and functional interfaces among the CI and other items of equipment, facilities, computer programs, and personnel.

Findings. The cross tabulation of the variables revealed a trend of moderately agree for all four purposes addressed by the survey question 10 - 13.

TABLE 30
PDR Participation vs Adequacy of Design Approach

Response	Had Particpated in a PDR YES	NO
Strongly Agree	44.51	34.37
Moderately Agree	47.25	48.44
Neither Agree or Disagree	2.20	12.50
Moderately Disagree	5.49	3.13
Strongly Disagree	0.55	1.56

TABLE 31
PDR Participation vs Design Approach Compatibility with Development Specification

Response	Had Particpated in a PDR YES	NO
Strongly Agree	35.16	31.25
Moderately Agree	45.60	46.87
Neither Agree or Disagree	13.74	15.62
Moderately Disagree	5.49	6.25

TABLE 32
PDR Participation vs Manufacturing Technical Risk

Response	Had Particpated in a PDR YES	NO
Strongly Agree	14.29	12.50
Moderately Agree	36.81	48.44
Neither Agree or Disagree	21.43	26.56
Moderately Disagree	21.98	9.37
Strongly Disagree	5.49	3.13

TABLE 33
PDR Participation vs Interface Definition

Response	Had Particpated in a PDR YES	NO
Strongly Agree	24.02	18.75
Moderately Agree	43.02	40.62
Neither Agree or Disagree	15.08	23.44
Moderately Disagree	13.41	14.06
Strongly Disagree	4.47	3.13

Investigative Question 3b. Do CDR experienced individuals perceive the Mil Std 1521 CDR purposes to be of greater importance than do those without CDR experience?

Discussion. Survey questions 6 and 17 through 22 was used to address this investigative question. This question addressed how useful the Mil Std is to managers and engineers by examining the separate opinions of those respondents that have and have not participated in a CDR.

The cross tabulation was used to examine the relationship of the responses to survey questions 17 through 22 against the CDR experience variable.

Survey Question 6:

Number of Preliminary Design Reviews you have formally participated in.

Survey Question 17:

To determine that the detailed design of the configuration item under review satisfies the performance and engineering specialty requirements of the CI development specifications.

Survey Question 18:

To establish the detail design compatibility among the CI and other items of equipment, facilities, computer programs.

Survey Question 19:

To assess the configuration item risk areas (on a technical, cost and schedule basis).

Survey Question 20:

To assess the results of the producibility analyses conducted on system hardware design.

Survey Question 21:

To review the preliminary product specification.

Survey Question 22:

To review major design modifications.

Findings. The cross tabulation of the variables revealed a trend of moderate to strong agreement for all four purposes addressed by the survey question 17 - 22. For survey question 21 the responses were independent of whether

the individual had or had not participated in a CDR. The distribution between those that agree and those that disagree were approximately the same with a slight tendency toward moderate agreement, but a total of 45.59 percent and 36.93 percent of those who have not and have, respectively, attended CDR had a tendency to neither agree nor disagree or Moderatedly disagree with the stated purposes of this survey question.

TABLE 34
CDR Participation vs Adequacy of Design Approach Compatibility with the Development Specification

Response	Had Particpated in a CDR YES	NO
Strongly Agree	64.61	48.53
Moderately Agree	33.15	42.65
Neither Agree or Disagree	.56	5.88
Moderately Disagree	1.69	2.94

TABLE 35
CDR Participation vs Establish Interface Definition

Response	Had Particpated in a CDR YES	NO
Strongly Agree	43.82	36.76
Moderately Agree	49.44	45.59
Neither Agree or Disagree	1.69	10.29
Moderately Disagree	4.49	5.88
Strongly Disagree	0.56	1.47

TABLE 36
CDR Participation vs Assess Risk Areas

Response	Had Particpated in a CDR YES	NO
Strongly Agree	25.28	16.18
Moderately Agree	53.37	60.29
Neither Agree or Disagree	10.67	16.18
Moderately Disagree	9.55	4.41
Strongly Disagree	1.12	2.94

TABLE 37
CDR Participation vs Assess Producibility

Response	Had Particpated in a CDR YES	NO
Strongly Agree	17.34	16.18
Moderately Agree	50.29	52.94
Neither Agree or Disagree	24.28	20.59
Moderately Disagree	6.94	8.82
Strongly Disagree	1.16	1.47

TABLE 38
CDR Participation vs Review
Preliminary Product Specification

Response	Had Particpated in a CDR YES	NO
Strongly Agree	15.34	8.82
Moderately Agree	41.48	41.18
Neither Agree or Disagree	21.02	17.65
Moderately Disagree	15.91	27.94
Strongly Disagree	6.25	4.41

TABLE 39
CDR Participation vs Review
Major Design Modifications

Response	Had Particpated in a CDR YES	NO
Strongly Agree	27.68	20.59
Moderately Agree	34.46	35.29
Neither Agree or Disagree	10.17	14.71
Moderately Disagree	20.34	25.00
Strongly Disagree	7.34	4.41

PDR/CDR Effectiveness/Efficiency Measures

Tables 40 through 63 covers the category of PDR and CDR effectiveness and efficiency measures.

Investigative questions four through sixteen posed in chapter one are addressed here.

Investivative Question 4a. What approval was given at the conclusion of the PDR?

Discussion. Survey question 32 asked what was the PDR approval rating given at the last PDR participated in by the individual respondents.

Findings. Sixty-four percent of the respondents indicated the last PDR they participated in was approved contingent upon some action to be completed. Twenty-one percent indicated the PDR was approved outright and 10.5 percent did not know what approval rating was given. Only

Ø.6 percent indicated the PDR last participated in was disapproved.

TABLE 4Ø
Survey Question 32: PDR Approval

Response	# of Respondents	% of Respondents
Approved	39	21.5
Approved Contingent	117	64.6
Approved with waiver	5	2.8
Disapproved	1	Ø.6
Did Not Know	19	1Ø.5
Total	181	1ØØ.Ø

Investigative Question 4b. What approval was given at the conclusion of the CDR?

Discussion. Survey queston 41 asked what was the CDR approval rating given at the last CDR participated in by the individual respondents.

Findings. Sixty-three percent of the respondents indicated the last CDR they participated in was approved contingent upon some action to be completed. Twenty-one percent indicated the CDR was approved outright and 8.5 percent did not know what approval rating was given. Only 2.8 percent indicated the last CDR they participated in was disapproved.

TABLE 41
Survey Question 41: CDR Approval

Response	# of Respondents	% of Respondents
Approved	37	21.0
Approved Contingent	112	63.6
Approved with waiver	7	4.0
Disapproved	5	2.8
Did Not Know	15	8.5
Total	176	100.0

Investigative Question 5a. Did the PDR provide an adequate evaluation of the system to proceed into the next acquisition phase?

Discussion. Survey question 6 and 56 were analyzed together to determine the respondents opinions of how adequate the PDR was in evaluating the system.

Survey Question 6:

Number of Preliminary Design Reviews you have formally participated in.

Survey Question 56:

In your opinion, did the last or current program PDR and CDR you attended adequately evaluate the system to allow it to proceed into the next acquisition phase.

Findings. Seventy percent of the respondents indicated the last PDR they had participated in adequately evaluated the system.

Examination of responses to survey question 56 with the responses grouped into those with PDR experience and those

without PDR experience the result were different. Of those individuals having participated in PDRs, 77.22 percent indicated the last PDR adequately evaluated the system. Of those that had no previous PDR experience only 26.67 percent believed the PDR adequately evaluated the system, and 70 percent did not know whether the review was adequate or not.

TABLE 42
PDR Participation vs Adequacy of System Evaluation

Response	Had Participated in a PDR YES	NO
Yes	77.22	26.67
No	18.33	3.33
Did Not Know	3.33	70.00
Not Important	1.11	---

Investigative Question 5b. Did the CDR provide an adequate evaluation of the system to proceed into the next acquisition phase?

Discussion. Survey question 6 and 56 were analyzed together to determine the respondents opinions of how adequate the PDR was in evaluating the system.

Survey Question 6:

Number of Preliminary Design Reviews you have formally participated in.

Survey Question 56:

In your opinion, did the last or current program PDR and CDR you attended adequately evaluate the system to allow it to proceed into the next acquisition phase.

Findings. Sixty-one percent of the respondents indicated the last CDR they had participated in adequately evaluated the system.

Examination of responses to survey question 56 with the responses grouped into those with CDR experience and those without CDR experience the result are much different. Of those individuals having participated in CDR 69.49 percent indicated the last CDR adequately evaluated the system. Of those that had no previous CDR experience, only 26.32 percent believed the PDR adequately evaluated the system, and 65.79 percent did not know whether the review was adequate or not.

TABLE 43
CDR Participation vs Adequacy of System Evaluation

Response	Had Participated in a CDR YES	NO
Yes	69.49	26.32
No	23.73	5.26
Did Not Know	5.65	65.79
Not Important	1.13	2.63

Investigative Question 6a. Were all AIs resolved before the PDR approval was given?

Discussion. Survey question 31 asked if all action items were resolved before an approval of the PDR was given.

Findings. Forty-eight percent of the respondents indicated all AIs were not resolved before the PDR approval was given. Thirty-three percent of the respondents indicated all AIs were resolved before the PDR approval was given and 18.2 percent did not know if the AIs were resolved before the PDR approval was given.

TABLE 44
Survey Question 31: PDR Action Item Resolution

Response	# of Respondents	% of Respondents
Yes	60	33.1
No	88	48.6
Did Not Know	33	18.2
Total	181	99.9

Investigative Question 6b. Were all AIs resolved before the CDR approval was given?

Discussion. Survey question 39 asked if all action items were resolved before an approval of the CDR was given.

Findings. Forty-four percent of the respondents indicated all AIs were not resolved before the CDR approval was given. Thirty-nine percent of the respondents indicated all AIs were resolved before the CDR approval was given and 15 percent did not know if the AIs were resolved before the CDR approval was given.

TABLE 45
Survey Question 39: CDR Action Item Resolution

Response	# of Respondents	% of Respondents
Yes	67	39.9
No	77	44.5
Did Not Know	26	15.0
Not Important	1	0.6
Total	171	100.0

Investigative Question 7a. Were any AIs left open at the conclusion of the PDR?

Discussion. Survey question 45 asked if any AIs were left opened at the conclusion of the PDR.

Findings. Seventy-three percent of the respondents indicated there were action items left open at the conclusion of the PDR they participated in last.

Seventeen percent of the respondents indicated they did not know if any action items were left open at the conclusion of the PDR.

TABLE 46
Survey Question 45: PDR Open Action Items

Response	# of Respondents	% of Respondents
Yes	156	73.9
No	18	8.5
Did Not Know	37	17.5
Total	211	99.9

Investigative Question 7b. Were any AIs left open at the conclusion of the CDR?

Discussion. Survey question 45 asked if any AIs were left opened at the conclusion of the CDR.

Findings. Sixty-five percent of the respondents indicated there were action items left open at the conclusion of the CDR they participated in last.

Twenty-three percent of the respondents indicated they did not know if any action items were left open at the conclusion of the CDR.

TABLE 47
Survey Question 45: CDR Open Action Items

Response	# of Respondents	% of Respondents
Yes	148	65.8
No	23	10.2
Did Not Know	53	23.6
Not Important	1	0.4
Total	225	100.0

Investigative Question 8a. Of AIs presented at the PDR were any issued previously and were these closed prior to the PDR completion?

Discussion. Survey question 46 asked if AIs presented at the PDR already existed as previous meeting issues. Survey questions 47 asked if these action items

were resolved prior to the completion of the PDR. Only the reponses of individuals having participated in a PDR were examined.

Findings. Over 79.13 percent of the respondents indicated the AI presented at the PDR already existed. Only 42.86 percent claimed that existing AIs were resolved or closed prior to the completion of the PDR. Over half, 51.65 percent indicated these AIs were not resolved or closed prior to the completion of the PDR.

Investigative Question 8b. Of AIs presented at the CDR how many were issued previously and were these closed prior to the CDR completion?

Discussion. Survey question 46 asked if AIs presented at the CDR already existed as previous meeting issues. Survey questions 47 asked if these action items were resolved prior to the completion of the CDR. Only the responses of individuals having pariticipated in a CDR were examined.

Findings. Over 86.78 percent of the respondents indicated that the AIs presented at the CDR already existed. Only 39.05 percent claimed that existing AIs were resolved or closed prior to the completion of the PDR. Fifty-seven percent indicated these AIs were not resolved or closed prior to the completion of the CDR.

Investigation Question 9a. Should all AIs be resolved before entering a PDR?

Discussion. Survey question 6, 9 and 15 response data were compiled and analyzed against this investigative question. The survey question asked if the respondent believed that all AIs should be resolved before entering a PDR. Survey question 6 and 9 provided the data to determine if the responses were dependent upon their PDR experience and DAFSC, respectively.

Findings. Of those individuals having participated in PDRs, 50 percent of DAFSC 2716 claimed all action items should be resolved before approving the PDR, 58.62 percent of DAFSC 2816 claimed all action items should be resolved before approving the PDR, 52.94 percent of DAFSC 2724 claimed all action items should be resolved before approving the PDR and 49.38 percent of DAFSC 28X5 claimed all action items should be resolved before approving the PDR.

TABLE 48
DAFSC vs Prior To PDR
Action Items Resolution

DAFSC	YES	NO	DO NOT KNOW	NOT IMPORTANT
2716	50.00	41.67	5.56	2.78
2816	34.48	58.62	6.90	--
2724	52.94	41.18	5.88	--
28X5	43.21	49.38	6.17	1.23

Investigation Question 9b. Should all AIs be resolved before entering a CDR?

Discussion. Survey question 6, 9 and 23 response data were compiled and analyzed against this investigative question. The survey question asked if the respondent believed that all AIs should be resolved before entering a CDR. Survey question 6 and 9 provided the data to determine if the responses were dependent upon their CDR experience and DAFSC, respectively.

Findings. Of those individuals having participated in CDRs, 54.55 percent of DAFSC 2716 claimed all action items should be resolved before approving the CDR, 62.07 percent of DAFSC 2816 claimed all action items should be resolved before approving the CDR, 60.61 percent of DAFSC 2724 claimed all action items should be resolved before approving the CDR and 78.31 percent of DAFSC 28X5 claimed all action items should be resolved before approving the CDR.

TABLE 49
DAFSC vs Prior To CDR
Action Items Resolution

DAFSC	YES	NO	DO NOT KNOW	NOT IMPORTANT
2716	54.55	39.39	3.03	3.03
2816	62.07	34.48	3.45	--
2724	60.61	30.30	6.06	--
28X5	78.31	18.07	1.20	2.41

Investigative Question 10. Were there slippages in the system/subsystem design/development schedule and CDR schedule?

Discussion. Survey question 44 asked if the last program CDR participated in had a CDR schedule slip and the number of weeks slipped. Survey question 52 asked if the last program worked if there were slips in the system and subsystem design and development and number of subsystems and weeks slipped.

Each question results are presented and the results of crosstabulation and the chi square test for dependency on these two questions was used to reveal the relationship of the slippage in system design and CDR slippage.

Findings. Sixty percent of all respondents indicated the system/subsystem design/development schedule slipped on their last program. Sixteen percent indicated no slippage and 22.2 percent did not know.

TABLE 50
Survey Question 52: System Development Schedule Slip

Response	# of Respondents	% of Respondents
Yes	136	60.4
No	37	16.4
Did Not Know	50	22.2
Not Important	2	0.9
Total	225	99.9

Fifty-nine percent of all respondents indicated the CDR slipped on their last program. Seventeen percent indicated no slippage and 21.4 percent did not know.

TABLE 51
Survey Question 44: CDR Schedule Slip

Response	# of Respondents	% of Respondents
Yes	138	59.0
No	42	17.9
Did Not Know	50	21.4
Not Important	3	1.3
Total	233	99.6

Analysis of the results of the two survey questions revealed that 74.07 percent of those respondents having said yes to system design/development slippage also indicated yes to the CDR slippage. Of those respondents indicating no to system design/development slippage 55.56 percent indicated no to CDR slippage. The chi square goodness of fit test revealed strong dependency between the responses of the two questions.

The largest group of respondents indicated their last system/subsystem design/development and CDR schedules slipped (45.05 percent of all respondents).

TABLE 52
CDR Slip vs System/Subsystem Slip

percent
row percent
col percent

CDR Slip	System/Subsystem Slip: YES	NO	DO NOT KNOW	NOT IMPORTANT
YES	45.05	5.86	8.56	0.45
	75.19	9.77	14.29	0.75
	74.07	36.11	38.78	50.00
NO	5.86	9.01	3.15	0.45
	31.71	48.78	17.07	2.44
	9.63	55.56	14.29	50.00
DO NOT KNOW	8.56	1.35	9.91	--
	43.18	48.78	17.07	2.44
	14.07	8.33	44.90	--
NOT IMPORTANT	0.90	--	0.45	--
	66.67	--	33.33	--
	1.48	--	2.04	--

STATISTIC	DEGREE OF FREEDOM	VALUE	PROBABILITY
CHI-SQUARE	12	67.610	0.000

The data revealed, of those respondents having indicated slips in the system/subsystem design/development, there were 97 system/subsytems slipped for an average of over 2 per program with a standard deviation of 2.30 and a range from 0 to 12.

The average length of a slip was 17.3 weeks with a standard deviation of 18.51 and a range from 0 to 99 weeks.

Of the 126 respondent claiming a slip in the CDR

schedule the average slip was 10.48 weeks with a standard deviation of 11.13 and a range from 1 to 56 weeks.

Investigative question 11. Should the design be complete before approving a CDR?

Discussion. Survey question 6,9 and 42 were used to analyze this question. Only the individuals with previous CDR experience were considered against the different DAFSCs.

Survey Question 6:

Number of Preliminary Design Reviews you have formally participated in.

Survey Question 9:

Duty AFSC.

Survey Question 42:

The CDR should not be conducted until the detailed design of each configuration item is complete.

Findings. Of the respondents having participated in a CDR, 68.75 percent of the DAFSC 2716 said the CDR should not be conducted until the detailed design of each configuration item is complete, 64.29 percent of DAFSC 2816, 67.74 percent of DAFSC 2724 and 75.90 percent of DAFSC 28X5 agreed that a design should be complete before conducting a CDR.

TABLE 53
DAFSC vs Survey Question 42: Complete Design

DAFSC	YES	NO	DO NOT KNOW	NOT IMPORTANT
2716	68.75	31.25	--	--
2816	64.29	35.71	--	--
2724	67.74	25.81	6.45	--
28X5	75.90	19.28	4.82	--

Investigative question 12. Were major design problems and modifications presented at the CDR and did any of these exist previously?

Discussion. Survey question 40 asked if there were any major design modifications presented at the respondents last CDR and if there were, how many. Survey question 48 asked if design problems presented at the respondents last CDR were covered in previous meetings.

Findings. Forty-six percent of the respondents claimed major design modifications were presented at their last CDR. Thirty-nine percent said none were presented and 13.1 percent did not know.

TABLE 54
Survey Question 40: CDR Design Modifications

Response	# of Respondents	% of Respondents
Yes	81	46.0
No	70	39.8
Did Not Know	23	13.1
Not Important	2	1.1
Total	176	100.0

The quantity of design mods present averaged 3.22 per positve response to this question. This had a standard deviation of 2.595 and the number of mods presented ranged from 0 to 15.

Sixty-nine percent of the respondents indicated the design problems presented at their last CDR were covered in previous meetings. Only 6.9 percent said no and 22.8 percent did not know.

TABLE 55
Survey Question 48: Previous Coverage of CDR Design Modifications

Response	# of Respondents	% of Respondents
Yes	162	69.8
No	16	6.9
Did Not Know	53	22.8
Not Important	1	0.4
Total	232	99.9

Investigative question 13. Were the CDR supporting data packages effective in supporting the system review (i.e. complete, delivered on time)?

Discussion. Survey question 50 asked if the respondent had adequate time to review the CDR supporting data packages to their satisfaction and were their comments addressed sufficiently by the contractor prior to the CDR.

Survey question 51 asked if the respondent last CDR supporting data packages were complete and delivered on schedule.

Findings. Forty-nine percent of the respondents claim they did not have adequate time to review the CDR supporting data packages to their satisfaction and that the comments were insufficiently addressed by the contractor prior to the CDR. Thirty-six percent indicated they did have adequate time and comments were addressed by the contractor sufficiently, and 13.8 percent did not know.

TABLE 56
Survey Question 50: Adequate Review Time for CDR Data

Response	# of Respondents	% of Respondents
Yes	81	36.0
No	112	49.8
Did Not Know	31	13.8
Not Important	1	0.4
Total	225	100.0

Only, 44.1 percent of the respondents indicated the CDR packages were complete. While 37.6 percent indicated the CDR data packages were incomplete and 17.8 percent did not know.

TABLE 57
CDR Data Package Complete
Survey Question 51

Response	# of Respondents	% of Respondents
Yes	89	44.1
No	76	37.6
Did Not Know	36	17.8
Not Important	1	0.5
Total	202	100.0

Thirty-six percent indicated the CDR data packages were delivered on schedule. Forty-four percent indicated they were not and 18.1 percent did not know.

TABLE 58
CDR Data Package Delivered On Time
Survey Question 51

Response	# of Respondents	% of Respondents
Yes	80	36.2
No	99	44.8
Did Not Know	40	18.1
Not Important	2	0.9
Total	221	100.0

Investigative question 14a. Should there be a system overview or tutorial as part of a PDR and how much of a PDR should be devoted to system overview and tutorials?

Discussion. Survey question 16 asked how many hours of a PDR should be devoted to system overview and tutorial information. Survey questions 6 and 9 were used to gather the responses to question 16 by the group of individuals having participated in a PDR and identifing responses against the DAFSC.

Findings. Of the 74 percent of the respondents having participated in PDRs; 65.17 (Table 4.59) percent indicated less than 2 hours of a PDR should be devoted to system overview and tutorial, 29.44 percent claimed 3 to 5 hours, 3.89 percent claimed 5 to 9 hours and 1.11 percent claimed 10 or more hours.

Fifty-eight percent of DAFSC 2716, 71.43 percent of DAFSC 2816, 70.59 percent of DAFSC 2724 and 64.2 percent of DAFSC 28X5 selected 0 to 2 hours as the amount of PDR time that should be devoted to system overview and tutorial.

TABLE 59
DAFSC vs PDR Tutorial Hours

DAFSC	0 - 2	3 - 5	6 - 9	10 PLUS
2716	58.33	36.11	2.78	2.78
2816	71.43	21.43	7.14	--
2724	70.59	29.41	--	--
28X5	64.20	29.63	4.94	1.23

Investigative question 14b. Should there be a system overview or tutorial as part of a CDR and how much of a CDR should be devoted to system overview and tutorials?

Discussion. Survey question 24 asked how many hours of a CDR should be devoted to system overview and tutorial information. Survey questions 6 and 9 were used to gather the responses to question 24 by the group of individuals having participated in a CDR and identifing responses against the DAFSC.

Findings. Of the 72.4 percent of the respondents having participated in CDRs; 66.86 (Table 4.60) percent indicated less than 2 hours of a CDR should be devoted to system overview and tutorial, 25.29 percent claimed 3 to 5 hours, 5.75 percent claimed 5 to 9 hours and 2.3 percent claimed 10 or more hours.

Fifty-seven percent of DAFSC 2716, 75 percent of DAFSC 2816, 78.79 percent of DAFSC 2724 and 62.5 percent of DAFSC 28X5 selected 0 to 2 hours as the amount of CDR time that should be devoted to system overview and tutorial.

TABLE 60
DAFSC vs CDR Tutorial Hours

DAFSC	0 - 2	3 - 5	6 - 9	10 PLUS
2716	57.58	36.36	6.06	--
2816	75.00	17.86	7.14	--
2724	78.79	21.21	--	--
28X5	68.50	25.00	7.50	5.00

Investigative question 15a. What correlation exist between an individual's opinion of the amount of system overview required to the amount conducted on the last PDR?

Discussion. Survey questions 16 and 30 were used to determine the correlation between the amount of time an individual claimed should be devoted to PDR system overview and amount actually presented at the respondents last PDR. SAS Proc Corr was used to compute the correlation factor. A strong correlation to this question would indicate the amount of system overview presented at a PDR is in alignment with the perceived amount of system overview time required in a PDR.

Findings. Sixty-five percent of the individuals claimed less than 2 hours should be devoted to system overview. Sixty-eight and 26.72 percent of these indicated less than 2 hours and 3 to 5 hours of the last PDR were devoted to system overview, respectively.

Twenty-nine percent of individual claimed 3 to 5 hours should be devoted to system overview. Forty-two and 38.46 percent of these indicated less than 2 hours of the last PDR were devoted to system overview, respectively. There was a significant correlation of .449 between what the individual claimed should be devoted toward system overview and how much was devoted to system overview on individual's last PDR.

TABLE 61
Recommended vs Actual PDR Overview
Survey Question 16 vs Survey Question 30

Perceived Amount of Overview (hours)	Amount of Overview Last PDR (Hours)				
	0 -2	3 - 5	6 - 9	10 or More	Total
0 - 2	69.97	26.72	3.45	0.86	65.17
3 - 5	42.31	38.46	15.38	3.85	29.21
6 - 9	12.50	37.50	37.50	12.50	4.49
10 or More	--	--	0.56	0.56	1.12

Investigative question 15b. What correlation exists between an individual's opinion of the amount of system overview required to the amount conducted on the last CDR?

Discussion. Survey questions 24 and 38 were used to determine the correlation between the amount of time an individual claimed should be devoted to CDR system overview and amount actually presented at the respondents last CDR. SAS Proc Corr was used to compute the correlation factor. A strong correlation to this question would indicate the amont of system overview presented at a CDR is in alignment with the perceived amount of system overview time required in a CDR.

Findings. Sixty-six percent of the individuals claimed less than 2 hours should be devoted to system overview. Seventy-six and 19.47 percent of these indicated less than 2 hours and 3 to 5 hours of the last CDR were devoted to system overview, respectively.

Twenty-four percent of individual claimed 3 to 5 hours should be devoted to system overview. Fifty and 38.14 percent of these indicated less than 2 hours of the last CDR were devoted to system overview, respectively. There was a significant correlation of .481 between what the individual claimed should be devoted toward system overview and how much was devoted to system overview on the individual's last CDR.

TABLE 62
Recommended vs Actual CDR Overview
Survey Question 24 vs Survey Question 38

Perceived Amount of Overview (hours)	Amount of Overview Last CDR (Hours)				
	0 - 2	3 - 5	6 - 9	10 or More	Total
0 - 2	76.11	19.47	4.42	--	66.86
3 - 5	50.00	38.10	9.52	2.38	24.85
6 - 9	20.00	30.00	20.00	30.00	5.92
10 or More	25.00	--	50.00	25.00	2.37

Investigative question 16. Were AF participants required to state their individual PDR and CDR objectives?

Discussion. Survey question 49 asked if during the Air Force meeting prior to the PDR and CDR if all AF participants were required to state their individual PDR and CDR objectives.

Findings.. An overwhelming 77.8 percent indicated the AF participants were not required to state their individual PDR and CDR objectives prior to the PDR or CDR. Twenty-one percent indicated they were required to state their objectives.

TABLE 63
Survey Question 49: Participants Objectives Stated

Response	# of Respondents	% of Respondents
Yes	47	21.8
No	168	77.8
Did Not Know	1	0.5
Total	216	100.0

PDR/CDR Training and Guidance

Tables 64 through 69 covers the category of PDR and CDR training and guidance.

Investigative questions seventeen through twenty posed in chapter one are addressed here.

Investigative question 17. What type of PDR and CDR training and guidance has the individual team member had?

Discussion. Survey question 43 asked if the individual had any guidance on how to conduct himself during a PDR or CDR, and if so, was it self taught, training, etc.

Cross tabulation of the survey question and specific DAFSC were examined.

Findings. Fifty-three percent of all respondents indicated they had some type of guidance or training on how to conduct themselves during PDRs and CDRs. Forty-six percent of all respondents indicated they did not have any guidance training.

Seventy percent of DAFSC 2716, 52.63 percent of DAFSC 2816, 57.45 percent of DAFSC 2724, and only 45.69 percent of DAFSC 28X5 indicated having some type of guidance and training on how to conduct themselves at PDRs and CDRs.

TABLE 64
DAFSC vs Prior Review Training

DAFSC	YES	NO
2716	70.45	29.55
2816	52.63	47.37
2724	57.45	42.55
28X5	45.69	54.31

Table 65 summarizes some of the training and guidance received by the respondents. The table shows the most frequently mentioned guidance by DAFSC.

The most common guidance were self taught, on job training, observation and Mil Std 1521.

Additional comments to this question are included in the Appendix C: Selected Comments.

TABLE 65
Training/Guidance Received

DAFSC	TYPE
2716	Self Taught AF Regulations Direct supervision DSMC Inhouse Training PMD AFIT short courses Observation Group discussions
2724	Self taught On Job Training Instruction from engineering personnel direct supervision Mil Std 1521
2816	Mil Std 1521 Self taught On Job Training Attending other related system PDR/CDRs Observation DSMC
28X5	Self taught By doing and asking others On Job Training Observing In house training Mil Std 1521 Short courses

Investigative question 18. Would initial PDR/CDR training be useful?

Discussion. Survey question 53 asked the individual if initial PDR/CDR training would be useful. Survey question 9 and 53 together address this investigative question by DAFSC.

Findings. Eighty-six percent of all respondents indicated initial training would be useful. Only 6.7 percent indicated initial training would not be useful and 5.4 percent did not know.

TABLE 66
Survey Question 53: Initial Review Training

Response	Percentage of Respondents
Yes	86.2
No	5.4
Did Not Know	6.7
Not Important	0.8
Total	97.1

Investigative question 19a. How much acquisition experience should an individual have before participating in a PDR?

Discussion. Survey question 54 asked the respondent how many months of acquisition experience should one have before participating in a PDR. Only individuals having participated in PDR were examined. The response to the survey question was examined against the individual's DAFSC.

Findings. Table 67 shows the distribution by DAFSC of the number of months of acquisition experience an individual should have before participating in a PDR. The five most frequent indications were 30.72 percent stating 6

months, 28.31 percent stating 12 months, 8.43 percent stating 0 months, 7.83 percent stating 3 months and 6.63 percent stating 24 months of acquisition experience needed before participating in a PDR.

Forty-one percent of DAFSC 2716, claimed 12 months of acquisition experience was needed before participating in a PDR. Twenty-two percent of DAFSC 2716 claimed 6 months. Thirty-eight percent of DAFSC 2724 claimed 6 months. Sixteen percent of DAFSC 2724 claimed 3 months and another 16.13 percent claimed 12 months. Twenty-one percent of DAFSC 2816 claimed 6 months. Seventeen percent of DAFSC 2816 claimed 0 months. Fourteen percent of DAFSC 2816 claimed 3 months and another 14.29 percent claimed 12 months. Thirty-three percent of DAFSC 28X5 claimed 6 months and another 33.33 claimed 12 months. Eight percent of DAFSC 28X5 claimed 24 months.

TABLE 67
DAFSC vs Acquisition Experience Recommended Before PDR Participation

	Number of Months Recommended				
DAFSC	0	3	6	12	24
2716	9.68	3.23	25.58	41.94	6.45
2816	17.86	14.29	21.43	14.29	10.71
2724	3.23	16.13	38.71	16.13	--
28X5	6.67	4.00	33.33	33.33	8.00
Total	8.37	7.83	30.72	28.31	6.63

Investigative question 19b. How much acquisition experience should an individual have before participating in a CDR?

Discussion. Survey question 54 asked the respondent how many months of acquisition experience should one have before participating in a CDR. Only individuals having participated in CDR were examinded. The response to the survey question was examined against the individual's DAFSC.

Findings. Table 68 shows the distribution by DAFSC of the number of months of acquisition experience an individual should have before participating in a CDR. The five most frequent indications were 26.22 percent stating 12 months, 25 percent stating 6 months, 12.2 percent stating 24 months, 10.37 percent stating 18 months and 8.54 percent stating 0 months of acquisition experience needed before participating in a CDR.

Forty-one percent of DAFSC 2716 claimed 12 months of acquisition experience was needed before participating in a CDR. Twenty percent of DAFSC 2716 claimed 18 months. Thirteen percent of DAFSC 2716 claimed 6 months. Thirth-one percent of DAFSC 2724 claimed 6 months. Eighteen percent of DAFSC 2724 claimed 12 months. Twelve percent of DAFSC 2724 claimed 3 months. Twenty-five percent of DAFSC 2816 claimed 6 months. Seventeen percent of DAFSC 2816 claimed 0, 12 and 24 months, respectively. Twenty-six percent of DAFSC 28X5

claimed 6 and 12 months,respectively. Fourteen percent of DAFSC 28X5 claimed 24 months.

TABLE 68
DAFSC vs Acquisition Experience Recommended Before CDR Participation

	Number of Months Recommended				
DAFSC	0	6	12	18	24
2716	10.34	13.79	41.38	20.69	6.90
2816	17.86	25.00	17.86	3.57	17.86
2724	3.13	31.25	18.75	9.37	6.25
28X5	6.67	26.67	26.67	9.33	14.67
Total	8.54	25.00	26.22	10.37	12.20

Investigative question 20a. What is the single most useful guide for PDR procedural guidance?

Discussion. Survey question 55 asked the respondents to comment on what the single most important guide (ex. regulation, manual or standard) is for PDR prepartion.

The responses of those who had participated in PDR were examined.

Findings. The response of those individuals having participated in a PDR are summarized and grouped by DAFSC in the Table 69.

The three most common responses across all DAFSCs was the Mil Standard 1521, job experience and DSMC handbook Systems Engineering Management Guide.

Additional comments to this question are included in Appendix C: Selected Comments.

Investigative question 28b. What is the single most useful guide for CDR procedural guidance?

Discussion. Survey question 55 asked the respondents to comment on what the single most important guide (ex. regulation, manual or standard) is for CDR prepartion.

The responses of those who had participated in CDR were examined.

Findings. The response of those individuals having participated in a CDR are summarized and grouped by DAFSC in Table 69.

The three most common responses across all DAFSCs was the Mil Std 1521, job experience and the DSMC handbook, System Engineering Management Guide.

Additional comments to this question are included in Appendix C: Selected Comments.

TABLE 69
PDR/CDR Guidance Recommended

DAFSC	TYPE
2716	AF Regulations Mil Std 1521 DSMC System Engineering Management Guide Group Meetings within SPO PMD
2724	AF Regulation 800-3 Mil Std 1521 DSMC System Engineering Management Guide
2816	Mil Std 1521 DSMC System Engineering Management Guide
28X5	Project Officers Handbook Mil Std 1521 DSMC System Engineering Management Guide

V. Conclusions and Recommendations

Overview

Success of a review depends on both Government and contractor preparation before the meeting (3:13-9).

Webster (16:9) states, "The staff meeting is a time to report on your homework, not to do it."

The effectiveness of technical meetings or design reviews can be seen through the results of design reviews evaluated based on the number of established action items, frequency of design changes and post review investigations (10:213).

Review

This chapter presents the conclusions and recommendations that can be drawn from this research effort. Although, the survey response rate was low it could easily support a confidence level between 85 and 90 percent. This confidence level could, for opinions and attitudes, allow for inference of the research results to the entire Air Force population.

The major limitation of the research was the exclusion of civil service employees and contracting personnel.

The twenty investigative questions examined three major areas of PDRs and CDRs: the purposes as stated in Mil Std

1521, PDR/CDR effectiveness/efficiency, and PDR/CDR training and guidance.

The following sections discuss conclusions drawn from the results presented in chapter four.

Military Standard 1521 PDR/CDR Purposes. The results of investigative questions one through three pertain to this area of research.

The results of the research indicated that PDR and CDR tend to be conducted in accordance with Mil Std 1521, with the exception of providing adequate coverage of the technical risk associated with the manufacturing methods and processes, and adequate coverage of the physical and functional interfaces among the configuration items, other equipment, facilities and computer programs.

Those respondents who have and have not participated in PDRs and CDRs tend to agree with the stated PDR and CDR purposes of Mil Std 1521. The experience factor did not significantly impact the individual's opinion of the stated PDR/CDR purposes.

PDR/CDR Effectiveness/Efficiency. The results of investigative questions four through sixteen pertain to this area.

Over 68 percent of the respondents indicated the PDRs and CDRs they participated in last were approved contingent upon some action to be completed. Only 8.6 percent of the repondents indicated the last PDR they participated in was

disapproved, and only 2.8 percent said the same of their last CDR.

Before examing these questions it is interesting to note that over 70 percent of the respondents felt that the last PDR provided adequate evaluation of the system to take the next step in the acquisition process.

Over 60 percent felt the last CDR provided adequate evaluation of the system to proceed into the next acquisition phase.

However, less than 40 percent of the respondents indicated that all PDR and CDR action items were resolved before the PDR and CDR approval was given.

Over 65 percent indicated that at the conclusion of the PDR and CDR some action items remained open.

Of the AIs presented at the PDR and CDR, some already existed prior to the PDR/CDR as indicated by 79.13 percent and 86.78 percent for the survey respondents, respectively.

Program managers tend to believe that all action items should be resolved before entering a PDR, whereas, development engineers tend to be less concerned about action items being completed. Both, the majority of program managers and development engineers indicated all action items should be resolved before entering a CDR.

Although, the respondents felt all action items should be resolved before entering a CDR, less than 40 percent of the respondents indicated this to have taken place on their last program CDR attended.

Over 50 percent of all respondents indicated there were slippages in both system design and development and CDR schedules.

Over 64 percent felt that the system design should be complete prior to approving a CDR.

Forty-six percent claimed major design problems and modifications were presented at the last CDR they participated in and of these, 69.8 percent indicated the design problems were covered in previous meetings.

Examination of the respondents overall opinion of items to be complete before entering a CDR includes resolutions of all action items and a complete design. In addition, it was felt by the majority of respondents that all action items issured during a PDR or CDR should be resolved before the meeting is given an approval rating. Also, no major design modifications and problems should be presented at a CDR, especially if they had existed previously.

However, the trend of the respondents showed their last PDR and CDR to be just the opposite of what they felt should had been the case (i.e. action items resolved, no major design problems and modifications presented).

Forty-nine percent claimed there was inadequate time to review the CDR data package and 44.8 percent of the respondents claimed the data was not delivered on schedule. This leads to inadequate and insufficient review of the data and PDR/CDR objective preparation.

Majority of respondents felt there should be some system overview or tutorial presented at PDRs and CDRs, but most indicated no more than two hours. However, the trend for the last PDR and CDR ranged from less than two hours to nine hours for a PDR and less than two hours to five hours for a CDR.

Seventy-seven percent of the respondents indicated PDR and CDR participants were not required to state their individual objectives. This is the largest indication of how ill prepared AF participants are for upcoming PDRs and CDRs.

Another alarming concern is the frequency of "Did not know" responses for survey questions supporting investigative questions four through sixteen. For example 10.5 and 8.5 percent did not know what approval rating was given at a PDR and CDR, respectively. Seventy and 65.79 percent of those not having participated in PDRs and CDRs did not know if the specific meeting adequately evaluated the system before proceeding with the program. Similar percentages existed for the survey questions addressing action items, design problems and modifications, system design/development and CDR schedule slippages, CDR data package and system overview issues.

The conclusion is that individuals could only respond to the survey questions addressing them directly versus program issues.

Complete understanding of the program, its direction and overall importance of PDR and CDR seemed to be lacking.

PDR/CDR Training and Guidance. The results of ivestigative questions seventeen through twenty pertain to this area of research.

Except for the development engineers, company grade officers (over 58 percent in each DAFSCs) claimed to have had some former training and guidance on PDR/CDR procedures. Field grade program managers overwhelmingly (78.45 percent) claimed to have had previous PDR/CDR training and guidance. The most common types were self taught, on job training, observation and Mil Std 1521.

Over 86.2 percent of all respondents felt initial training would be useful.

On the issue of acquisition experience most respondents felt 6 to 12 months should be required before participation in a PDR and CDR.

The useful guidances recommended by the respondents most often was Mil Std 1521, prior experience and DSMC's handbook, System Engineering Management Guide.

Recommendations

As stated previously, in order to make inferences to the entire population working PDRs and CDRs, the civil service and contractor personnel should be surveyed.

To those individuals preparing for a PDR/CDR consider the following:

1. Early preparation and identifications of individual objectives is of the upmost importance.

2. Individuals should read and use Mil Std 1521 and DSMC's System Engineering Management Guide.

3. Each person should have at least 6 months acquisition experience prior to participating in a PDR and CDR.

4. Each person should understand the significance of action items, system overviews, establishing solid objectives and PDR/CDR preparation.

5. The program should not start CDR with major design problems in the works or significant action items unresolved.

6. CDRs should not be approved with unresolved action items and design issues.

7. Early in the program stages a CDR data delivery schedule should be established according to program size, review team size and data package size.

8. If data has not been completely reviewed and responses satisfactorily addressed, strong consideration should be given to slipping the CDR start date.

9. PDRs and CDRs should be more than contractually binding to be held, but to be satisfactorily completed with all significant action items and design problems resolved prior to a satisfactory approval.

10. Follow the stated purposes of Mil Std 1521.

11. Minimize the percentage of a CDR devoted to systems overview and tutorial.

12. Have each AF participant identify his objectives met at the conclusion of each day's meeting and also define his objectives for the remainder of the meeting.

Summary

PDR's and CDR's are two of the most critical technical meetings of a program which consumes large expenditures of time, money and resources from the AF and contractors.

The results of this research indicate most PDRs and CDRs are not as effective as they could be. Two of the primary reasons are the lack of knowledge on what should be accomplished by participants and the lack of sufficient contractual importance for complete and successful PDRs and CDRs.

Follow on research suggestions

Three specific areas for follow on research are:

1. Determine the opinions and attitudes of the civil service and contractor personnel on PDR and CDR procedures and effectiveness.

2. Evaluate the cost for the AF and the contractor to put on a PDR and CDR.

3. Determine specific inhouse PDR/CDR training that could be used by program managers and development engineers.

Appendix A: Questionnaire and Instructions

DEPARTMENT OF THE AIR FORCE USAF SCN 87-58
AIR UNIVERSITY
AIR FORCE INSTITUTE OF TECHNOLOGY
WRIGHT-PATTERSON AIR FORCE BASE OH 45433-6583

REPLY TO ATTN OF: LSY (Capt Bennett, AUTOVON 785-6569)

SUBJECT: Preliminary and Critical Design Review Procedures and Effectiveness Survey Package

TO:

1. Please take the time to complete the attached questionnaire and return it in the enclosed envelope by 29 May 1987.

2. The survey measures your perceptions and attitudes toward Preliminary and Critical Design Review procedures and their effectiveness in evaluating system design and development progress. The data we gather will become part of an AFIT research project and may influence Preliminary and Critical Design Review procedure changes. Your individual responses will be combined with others and will not be attributed to you personally.

3. Your participation is completely voluntary, but we would certainly appreciate your help. For further information please contact Capt Bennett at AUTOVON 785-6569.

JOHN DUMOND, Lt Col, USAF
Head, Department of System
Acquisition Management
School of Systems and Logistics

2 Atch
1. Survey
2. Return Envelope

STRENGTH THROUGH KNOWLEDGE

SURVEY PRELIMINARY AND CRITICAL DESIGN REVIEWS

Part I - Background Information

1. Military Rank :_____

2. Office Symbol:_____

3. With which acquisition phase are you most familiar?
(check the appropriate ones)
o Concept Exploration
o Demonstration/Validation
o Full Scale Development
o Production

4. With which type of acquisition are you most familiar?
(check the appropriate ones)
o Aircraft
o Armament
o Electronics
o Space/Missile
o Other (specify)
_____

5. Number of years of acquisition experience you have ?
(check one)
o 0-2 years
o 3-4 years
o 5-7 years
o 8-10 years
o 11-14 years
o more than 15 years

6. Number of Preliminary and Critical Design Reviews (System level) in which you have formally participated in:
PDR_____(number) CDR_____(number)

7. Current Functional Area: (check one)
o Program/Project Management
o Contracting/Manufacturing Management
o Engineering
o Configuration Management
o Logistics Management
o Test and Evaluation
o Other (please specify)_____

8. Education type (i.e. BS Electrical Engineering):
_____

9. Duty AFSC: (check one)
o 2716
o 2816
o .2724
o 28X5

Part II - Purpose of the Preliminary Design Review (PDR)

Questions 10-14 require a response, ranging from strongly agree to strongly disagree, concerning your opinion on the purpose of a PDR.

RESPOND TO QUESTIONS AS FOLLOWS:

Strongly agree	Agree	Neither agree nor disagree	Disagree	Strongly disagree
1	2	3	4	5

10. To evaluate the progress, technical adequacy, and risk resolution (on a technical, cost and schedule basis) of the selected design approach._____

11. To determine the design approach compatibility with performance and engineering specialty requirements of the Configuration Item (CI) development specification. _____

12. To assess the technical risk associated with the selected manufacturing methods/processes._____

13. To define the physical and functional interfaces among the CI and other items of equipment, facilities, computer programs, and personnel._____

14. To provide a system overview and tutorial for the PDR participants._____

15. Should all action items be resolved before approving the PDR ? (check one)

o yes o don't know
o no o not important

16. How many hours of the PDR should be devoted to system overview and tutorial information? (check one)

o 0 -2 hours o 6 -9 hours
o 3 -5 hours o 10 plus hours

Part III - Purpose of the Critical Design Review (CDR)

Questions 17-22 require a response, ranging from strongly agree to strongly disagree, concerning your opinion on the purposes of a CDR.

RESPOND TO QUESTIONS AS FOLLOWS:

Strongly agree	Agree	Neither agree nor disagree	Disagree	Strongly disagree
1	2	3	4	5

17. To determine that the detailed design of the configuration item under review satisfies the performance and engineering specialty requirements of the CI development specifications._____

18. To establish the detail design compatibility among the CI and other items of equipment, facilities, computer programs._____

19. To assess the configuration item risk areas (on a technical, cost and schedule basis)._____

20. To assess the results of the producibility analyses conducted on system hardware design._____

21. To review the preliminary product specification._____

22. To review major design modifications._____

23. Should all action items be resolved before approving the CDR. (check one)

o yes o don't know
o no o not important

24. How many hours of the CDR should be devoted to system overview and tutorial information. (check one)

o 0-2 hours o 6-9 hours
o 3-5 hours o 10 plus hours

Part IV - Last or current program PDR questions

IF YOU HAVE NOT PARTICIPATED IN A PDR SKIP PART IV.

Questions 25-29 require a response, ranging from strongly agree to strongly disagree, concerning your opinion on how the purposes of the last or current PDR you attended were satisfied.

RESPOND TO QUESTIONS AS FOLLOWS:

Strongly agree	Agree	Neither agree nor disagree	Disagree	Strongly disagree
1	2	3	4	5

25. The review adequately covered the technical adequacy of the selected design approach._____

26. The review adequately covered the risk resolution (on a technical, cost, and schedule basis) of the selected design approach._____

27. The review adequately covered the design approach capability in meeting the performance and engineering specialty requirements of the CI development specification._____

28. The review adequately covered the technical risk associated with selected manufacturing methods and processes._____

29. The review adequately covered the physical and functional interfaces among the CI and other equipment, facilities, computer programs, and personnel._____

30. How many hours of the PDR were devoted to system overview and tutorial information? (check one)

o 0-2 hours o 6-9 hours
o 3-5 hours o 10 plus hours

31. Were all action items resolved before an approval of the PDR was given? (check one)

o yes o don't know
o no o not important

32. What was the approval given ? (check one)

o approved
o approved contingent upon some action completed
o approved with a wavier
o disapproved
o don't know

Part V - Last or current program CDR questions

IF YOU HAVE NOT PARTICIPATED IN A CDR SKIP PART V.

Questions 33-37 require a response, ranging from strongly agree to strongly disagree, concerning your opinion on how the purposes of the last or current CDR you attended were satisfied.

RESPOND TO QUESTIONS AS FOLLOWS:

Strongly agree	Agree	Neither agree nor disagree	Disagree	Strongly disagree
1	2	3	4	5

33. The review adequately determined that the configuration item under review satisfied the performance and engineering specialty requirements of the CI development specification._____

34. The review adequately determined that the detailed design was compatible between the CI and the other items of equipment, facilities, and computer programs._____

35. The review adequately assessed the CI risk areas (on a technical, cost and schedule basis)._____

36. The review adequately assessed the producibility of the system hardware design._____

37. The review adequately covered the preliminary product specification._____

38. How many hours of the CDR were devoted to system overview and tutorial information. (check one)

o 0-2 hours o 6-9 hours
o 3-5 hours o 10 plus hours

39. Were all action items resolved before an approval of the CDR was given? (check one)

o yes o don't know
o no o not important

40. Were there any major design modifications presented? If so, approximately how many? (check one)

o yes quantity_____ o don't know
o no o not important

41. What was the CDR approval given? (check one)

o approved
o approved contingent upon some action completed
o approved with a wavier
o disapproved
o don't know

Part VI - General PDR and CDR questions

42. The CDR should not be conducted until the detailed design of each configuration item is complete. (check one)

o yes o no o don't know o not important

43. Have you had any guidance on how to conduct yourself during a review? If so, what type (self taught, training, education or direct supervision)? (check one)

o yes o no

describe:_____

44. On the last or current program you attended did the CDR schedule slip ? If so, give the approximate number of weeks._____ (weeks) (check one)

o yes o no o don't know o not important

45. On the last or current program you attended were there any AIs left opened at the conclusion of the PDR and CDR ? If so, how many ? (check one for PDR and CDR)

PDR	CDR		PDR	CDR	
o	o	yes	o	o	don't know
o	o	no	o	o	not important

If yes, quantity (PDR)_____ (CDR)_____

46. Of the action items presented at PDR or CDR did these already exist as previous meeting issues ? (check one for PDR and CDR)

PDR	CDR		PDR	CDR	
o	o	yes	o	o	don't know
o	o	no	o	o	not important

47. If you answered yes to question 46, answer the following question. Of these action items, were they resolved or closed prior to the completion of the PDR or CDR ? (check one for PDR and CDR)

PDR	CDR		PDR	CDR	
o	o	yes	o	o	don't know
o	o	no	o	o	not important

48. Were design problems presented at the CDR covered in previous meetings ? (check one)

o	yes	o	don't know
o	no	o	not important

49. During the last PDR or CDR AF only meeting, were all AF participants required to verbalize their individual objectives for the PDR and CDR ? (check one for PDR and CDR)

PDR	CDR		PDR	CDR	
o	o	yes	o	o	don't know
o	o	no	o	o	not important

50. Did you have adequate time to review the CDR supporting data packages to your satisfaction and were your comments addressed sufficiently by the contractor prior to the CDR ? If not explain. (check one)

o yes o don't know
o no o not important
o comments_____

51. Were the CDR supporting data packages complete and delivered on schedule ? (check one for complete and delivered)

complete	delivered		complete	delivered	
o	o	yes	o	o	don't know
o	o	no	o	o	not important

52. On the last or current program you attended were there slippages in the system and subsystem design and development ? If so, give the approximate number of subsystems and weeks of slippage in the critical path of the schedule. (check one)

o yes o don't know
o no o not important
If yes #subsystems____ #weeks____

53. Would initial PDR and CDR training be useful ? (check one)

o yes o don't know
o no o not important

54. How many months of acquisition experience should one have before participation in a PDR and a CDR ?

PDR_____ CDR_____ (months)

55. In your opinion, what is the single most important guide (ex. regulation, manual, standard) for preparing for a PDR and a CDR. (please be specific)

PDR_____
CDR_____

56. In your opinion, did the last or current program PDR and CDR you attended adequately evaluate the system to allow it to proceed into the next acquisition phase?(check one for PDR and CDR)

PDR	CDR		PDR	CDR	
o	o	yes	o	o	don't know
o	o	no	o	o	not important

57. On the last or current program PDR and CDR you attended approximately how many Air Force personnel participated in the meeting ? (check one for PDR and CDR)

PDR	CDR		PDR	CDR	
o	o	less than 10	o	o	25 - 34
o	o	10 - 24	o	o	35 or more

Appendix B: SAS Program

```
OPTIONS LINESIZE=84;
PROC FORMAT;
VALUE CURRENT
      .='DID NOT ANSWER'
      1='FIRST LIEUTENANT'
      2='CAPTAIN'
      3='MAJOR'
      4='LIEUTENANT COLONEL'
      5='COLONEL';
VALUE DUTY
      .='DID NOT ANSWER'
      1='2716'
      2='2816'
      3='2724'
      4='28X5'
VALUE COMMAND
      .='DID NOT ANSWER'
      1='AFSC'
      2='AFLC'
      3='TAC'
      4='MAC'
      5='SAC'
      6='AFCMD'
      7='ATC'
      8='AFCC'
      9='AU'
      10='HQ USAF/SAF'
      11='AFSPACMD'
      12='OTHER'
      13='AFOTEC'
      14='FSC';
VALUE DEGREE
      .='DID NOT ANSWER'
      1='BS ENGR'
      2='BS CHEMISTRY'
      3='BA MATH'
      4='BS OTHER'
      5='BA BUSINESS'
      6='BA MANAGEMENT'
      7='BS PSYCHOLOGY'
      8='BA OTHER'
      9='MS ENGR'
      10='MS CHEMISTRY'
      11='MS MATH'
      12='MS OTHER'
      13='MBA'
      14='MS PSYCHOLOGY'
      15='MA OTHER'
      16='PHD';
```

```
VALUE YEARS
      .='DID NOT ANSWER'
      1='- TO 2 YRS'
      2='3 TO 4 YRS'
      3='5 TO 7 YRS'
      4='8 TO 10 YRS'
      5='11 TO 14 YRS'
      6='MORE THAN 15 YRS';
VALUE LIKER
      .='DID NOT ANSWER'
      1='STRONGLY AGREE'
      2='MODERATELY AGREE'
      3='NEITHER AGREE/DISAGREE'
      5='STRONGLY DISAGREE'
VALUE PHASE
      .='DID NOT ANSWER'
      1='C/E'
      2='D/V'
      3='FSD'
      4='PROD';
VALUE TYPE
      .='DID NOT ANSWER'
      1='AIRCRAFT'
      2='ARMAMENT'
      3='ELECTRONICS'
      4='SPACE/MILLILE'
      5='OTHER';
VALUE FUNCT
      .='DID NOT ANSWER'
      1='PROGRAM/PROJECT MANAGEMENT'
      2='CONTRACTING/MANUFACTURING MANAGEMENT'
      3='ENGINEERING'
      4='CONFIGURATION MANAGEMENT'
      5='LOGISTICS MANAGEMENT'
      6='TEST AND EVLAUATION'
      7='OTHER';
VALUE YESNO
      .='DID NOT ANSWER'
      1='YES'
      2='NO'
VALUE FENSE
      .='DID NOT ANSWER'
      1='YES'
      2='NO'
      3='DO NOT KNOW'
      4='NOT IMPORTANT';
VALUE OVERVU
      .='DID NOT ANSWER'
      1='0 TO 2 HOURS'
      2='3 TO 5 HOURS'
      3='5 TO 9 HOURS'
      4='10 OR MORE HOURS';
VALUE QTYPERS
      .='DID NOT ANSWER'
```

```
      1='LESS THAN 16 PARTICIPANTS'
      2='16 TO 24 PARTICIPANTS'
      3='25 TO 34 PARTICIPANTS'
      4='35 OR MORE PARTICIAPNTS';
VALUE OJT
      .='DID NOT ANSWER'
      1='1 MONTHS'
      2='2 MONTHS'
      3='3 MONTHS'
      4='4 MONTHS'
      5='5 MONTHS'
      6='6 MONTHS'
      7='7 MONTHS'
      8='8 MONTHS'
      9='9 MONTHS'
      10='10 MONTHS'
      11='11 MONTHS'
      12='12 MONTHS'
      13='MORE THAN 12 MONTHS';
VALUE APPROVAL
      .='DID NOT ANSWER'
      1='APPROVED'
      2='APPROVED CONTINGENT'
      3='APPROVED WITH WAIVERS'
      4='DISAPPROVED'
      5='DO NOT KNOW';
DATA INIT;
      INFILE RESULT;
INPUT CURRENT 1 COMMAND 2-3 PHASE 4 TYPE 5 ACQEYRS 6
      PPARTIC 7 CPARTIC 8 PPARTICQ 9-10CPARTICQ 11-12
      FUNCT 13 DEGREE 14-15 DUTY 16 PPDR10 17 PPDR11 18
      PPDR12 19 PPDR12 20 PPDR 14 21 AIPDR 22 PSYSOV 23
      PCDR17 24 PCDR18 25 PCDR19 26 PCDR20 27 PCDR21 28
      PCDR22 29 AICDR30 CSYSOV 31 LPDR25 32 LPDR26 33 LPDR27
      34 LPDR28 35 LPDR29 36 LPSYOV 37 LPAI 38 LPAPPV 39
      LCDR33 40 LCDR34 41 LCDR35 42 LCDR36 43 LCDR37 44
      LCSYOV 45 LCAI 46 DSGMOD 47 DSGMODQ 48-50 LCAPPV 51
      CMPLDSG 52 GUIDNCE 53 CDRSLIP 54 CDRSLIPQ 55-56
      POPENAI 57 COPENAI 58 POPENAIQ 59-61 COPENAIQ 62-64
      PPREVAI 65 CPREVAI 66 PCLSEAI 67 CCLSEAI 68 DSGPROB 69
      VERBAL 70 # 2 CDRPREP 1 CCDRPK 2 DCDRPK 3 SLIP 4
      SLIPSUB 5-7 S;O[WLS 8-9 TRAING 10 PAQEXP 11-12
      CAQEXP 13-14 PREV 15 CREV 16 PPERSQ 17 CPERSQ 18;
LABEL CURRENT='CURRENT MILITARY RANK'
      COMMAND='ACQUISITION PHASE MOST FAMILIAR'
      PHASE='ACQUISITION PHASE MOST FAMILIAR'
      TYPE='ACQUISITION TYPE MOST FAMILIAR'
      ACQEYRS='YEARS OF ACQUISITION EXPERIENCE'
      PPARTIC='NUMBER OF PDRS PARTICIPATED IN'
      CPARTIC='NUMBER OF CDRS PARTICIPATED IN'
      FUNCT='CURRENT FUNCTIONAL AREA'
      DEGREE='EDUCATION TYPE
      DUTY='DUTY AFSC'
      PPDR10='P EVAL TECHN, COST, SCHDLE RISK TO DESIGN'
```

```
      PPDR11='P EVAL DESIGN TO REQUIREMENTS'
      PPDER12='P EVAL MANUF PROCESS RISK'
      PPDR13='P DEFINE INTERFACES'
      PPDR14='P SYSTEM OVERVIEW/TUTORIAL'
      AIPDR='P RESOLVE AIS BEFORE APPRVG PDR'
      PSYSOV='P PURPOSE # OF HOURS FOR SYS OVRVU/TUTO'
      PCDR17='C EVAL TECHN,COST,SCHEDULE TO DESIGN'
      PCDR18='C EVALUATE DESIGN TO REQUIREMENTS'
      PCDR19='C ASSESS CI T,C,S RISK'
      PCDR20='C ASSESS RESULTS OF PRODUCIBILITY ANAL'
      PCDR21='C REVIEW PRELIMINARY PRODUCT SPEC'
      PCDR22='C REVIEW MAJOR DESIGN MODS'
      AICDR='C RESOLVE AIS BEFORE APPROVING CDR'
      CSYSOV='C # OF HOURS FOR SYS OVERVIEW/TUTORIAL'
      LPDR25='LAST P ADQTLY EVALD TECHN DSGN APPROACH'
      LPDR26='LAST P ADQTLY EVALD T,C,S,RISK TO DSGN'
      LPDR27='LAST P ADQTLY EVALD DSGN TO REQRMNTS'
      LPDR28='LAST P ADQTLY EVALD MANUFG PROCESS RISK'
      LPDR29='LAST P ADQTLY DEFINED INTERFACES'
      LPSYOV='LAST P # OF HRS DEVTED TO SYS OVRVU/TUTO'
      LPAI='LAST P WERE AIS RESLVED BEFORE P APPRVL'
      LPAPPV='LAST PDR APPROVAL GIVEN'
      LCDR33='LAST C ADQTLY EVALD DSGN TO RQURMENTS'
      LCDR34='LAST C ADQTLY REVD DSGN COMPATIBILITY'
      LCDR35='LAST C ADQTLY ASSD CI T,C,S RISK'
      LCDR36='LAST C ADQTLY ASSD RSLTS OF PROBLTY ANAL'
      LCDR37='LAST C ADQTLY REVD PRELIM PROD SPEC'
      LCSYOV='LAST C # OF HRS DEVTD TO SYS OVERVU/TUTO'
      DSGMOD='LAST C WERE MAJ DSGN MODS PRESENTED'
      DSGMODQ='LAST C # OF MAJ DSGN MODS PRESENTED'
      LCAPPV='LAST CDR APPROVAL GIVEN'
      CMPLDSG='C NOT CNDCTD PRIOR TO DETLD DSGN COMPL'
      GUIDNCE='HAVE YOU ANY GUIDNCE ON PDR/CDR RELES'
      CDRSLIP='LAST CDR SCHEDULE SLIPPED'
      POPENAI='LAST PDR CONCLUSION AIS LEFT OPEN'
      COPENAI='LAST CDR CONCLUSION AIS LEFT OPEN'
      PPREVAI='LAST PDR AIS PRESENTED ALREADY EXISTED'
      CPREVAI='LAST CDR AIS PRESENTED ALREADY EXISTED'
      PCLSEAI='LAST P PREVS AIS CLSD AT COMPLN OF MTG'
      CCLSEAI='LAST C PREVS AIS CLSD AT COMPLN OF MTG'
      DSGPROB='LAST C DSGN PROBS COVERED IN ERLER MTG'
      VERBAL='RQRD TO VERBLIZE INDIVIDUAL OBJS'
      CDRPREP='ADQUATE TIME TO REV SUPPORTING CDR OBJ'
      CCDRPK='CDR SUPPORTING PACKAGE WAS COMPLETE'
      DCDRPK='CDR SUPPORTING PKG WAS DELVRD ON SCHED'
      SLIP='LAST PROG DSGN AND DVLMNT SCHDLE SLPED'
      TRAING='PDR/CDR TRAINING WOULD BE USEFUL'
      CAQEXP='# OF MO OF ACQ EXPERIENCE RQRD FOR CDR'
      PREV='LAST P ADQTLY TO ENTER NEXT ACQ PHASE'
      CREV='LAST C ADQTLY TO ENTER NEXT ACQ PHASE'
      PPERSQ='NUMBER OF AF PARTICPANTS AT LAST PDR'
      CPERSQ='NUMBER OF AF PARTICIPANTS AT LAST CDR'
FORMAT PPDR10 PPDR11 PPDR12 PPDR13 PPDR14 PCDR17 PCDR18
      PCDR19 PCDR20 PCDR21 PCDR22 LPDR25 LPDR26 LPDR27 LPDR28
```

```
      LPDR29 LCDR33 LCDR34 LCDR35 LCDR36 CDER37 LIKER.
      GUIDNCE VERBAL PPARTIC CPARTIC YESNO. AIPDR AICDR LPAI
      LCAI DSGMOD CMPLDSG CDRSLIP POPENAI COPENAI PPREVAI
      CPREVAI PCLSEAI CCLSEAI DSGPROB CDRPREP CCDRPK DCDRPK
      SLIP TRAING PREV CREV PENSE. PSYSOV CSYSOV LPSYOV
      LCSYOV OVERVU. PPERSQ CPERSQ QTYPERS. PAQEXP CAQEXP
      OJT. LPAPPV LCAPPV APPROVAL.;
PROC FREQ;
      TABLES CURRENT-- ACQEYRS;
      TABLES FUNCT--CDRSLIP;
      TABLES POPENAI;
      TABLES COPENAI;
      TABLES PPREVAI--SLIP;
      TABLES TRAING--CAQEXP;
      TABLES PPARTIC*(PPDR18--PPDR13);
      TABLES CPARTIC*(PCDR17--PCDR22);
      TABLES DUTY*(PPDR18--PPDR13);
      TABLES DUTY*(PCDR17--PCDR22);
      TABLES PPARTIC*(PPDR18--PPDR13)*(LPDR25--LPDR29);
      TABLES CPARTIC*(PCDR17--PCDR22)*(LCDR33--LCDR37);
      TABLES LPAI*LPAPPV;
      TABLES PPREVAI*PCLSEAI;
      TABLES CPREVAI*CCLSEAI;
      TABLES CDRSLIP*SLIP / CHISQ;
      TABLES PPARTIC*PREV;
      TABLES CPARTIC*CREV;
      TABLES PPARTIC*DUTY*PSYSOV;
      TABLES CPARTIC*DUTY*CSYSOV;
      TABLES PSYSOV*LPSYOV;
      TABLES CSYSOV*LCSYOV;
      TABLES PPARTIC*DUTY*AIPDR;
      TABLES CPARTIC*DUTY*AICDR;
      TABLES CPARTIC*DUTY*CMPLDSG;
      TABLES DUTY*GUIDNCE;
      TABLES DUTY*TRAING;
      TABLES PPARTIC*DUTY*PAQEXP;
      TABLES CPARTIC*DUTY*CAQEXP;
      TABLES DUTY*PPARTIC;
      TABLES DUTY*CPARTIC;
PROC CORR;
```

Appendix C: Selected Comments

Question 10:

"What about supportability."

Question 14:

"Should not have to be this way but is a very necessary step."

Question 15:

"Depends on action items."

"Often you discover one or two that were inappropriate at the time they were given for the stage of development, these can be passed on to CDR or eliminated.

"Some AI's are more important than others.

Question 16:

"Stupid answers, depends upon size of system."

"Depends on the size of the design. This should be expressed as a % of PDR time."

"This is very dependent upon system complexity."

"Depends on the size of the program."

"Strong function of system complexity and personnel turnover."

"No more than a half a day's effort."

"Varies depending on complexity of program, enough info should be presented so that praticipants understand the function and areas where technical concern is already apparent."

"None - too much time is spent preparing strap hangers who usually up to this point in time have not had active roles in the project. We waste too much time on dog and ponies. This costs tax payers. Before you have the SPO all pre-coordination and training should have been performed.

Question 19:

"What about supportability."

Question 21:

"Not at a CDR! Spec's should be well entrenches and understood by participants at this point, assumly no "new" players involved."

Question 22:

"If this occurs you have a second PDR in my book."

Question 23:

"Some minor items could be left to a later date but, if any chance they could cause serious problems they should be resolved before.

Question 24:

"Time spent depends upon the system in which the review is created to support. Different projects require different CDRs."

"However, depends on the system and its complexity."

"No more than half a day's effort."

"None - too much time is spend preparing strap hangers who usually up to this point in time have not had active roles in the project. We waste too much tidme on dog and ponies. This costs tax payers. Before you have the SPO all pre-coordination and training should have been performed.

Question 41:

"This was the only review (PDR orCDR) that I was involved in that was desapproved, though others I thought should have been."

Question 42:

"At least the major system CIs."

"Incremental are necessary on complex systems."

Question 43:

"Everyone including myself has no knowledge of what was going to happen at the PDR."

"Reviews should be used to clear up problems and to provide last minute design information. They should not be used as a tutorial (this wastes time). You should conduct yourself as a professional. Getting mad or loud is inappropriate.

"Learning from early reviews how to conduct (PDR, CDR, FCA, PCAS). Last reviews we briefed our people how to identify action and ask for resolution. This was absolutely essential when we had to disapprove the CDR."

Question 49:

"But this was held after PDR/CDR."

Question 50:

"Data not delivered prior to CDR."

"No real preparation on my part."

"The package of software documentation that arrived was incomplete; it was also a little late."

"The time required was too short; data was usually late and/or not sufficient."

"Never enough time."

"Engineering drawings lacked adequate detail."

"Time constraints - politically, CDR had to be held then."

"Review time adequate; comments not addressed prior to CDR."

"Data packages were incomplete."

"CDR packages do not arrive until 2-3 weeks prior to CDR."

"10 days is insufficient to review a thousand pages of documents and drawings."

"This is extremely important - a PDR/CDR dry run to the AF program manager/office should occur at least a few weeks prior to the review to approve content, format and delivery."

"Delivered at CDR."

"Always said they would get back to us."

"Insufficient time between getting documentation and PDR/CDRs."

"Contractor documents were later than required and at meeting he presented new data also."

"Delay in delivery and poor quality of CDR package precluded adequate review."

"Definitely a problem."

"Far too much to review."

"The packages always seem to be late creating a time crunch."

"Submitted only 5 days prior."

"CDR supporting data was not received in time to submit comments to the contractor prior to CDR."

"Support packages was delivered one week in advance. Package consisted of three thousand plus pages."

"The scheduled time of review was short because the information from the contractor was late."

"Not enough time to review but comments were addressed."

"Data delivered late and CDR proceeded to stay on schedule."

"Held the review with out properr review to preserve the project schedule."

"All documents were presented but as a joint program review was not complete until after the event."

"No data provided to CDR."

"Contractor's documentation abilities were very bad."

"Scheduled pressure."

"Review time and comment review cycle was too short. Approximately 1 month minimum is required for satellite level reviews."

"Contractor tried to press ahead without SPO approval."

"Data is never reviewed well enough by meeting attendees prior to meeting. Design reviews are rarely a "review" of anything - they're a presentation of design that most attendees did not do their homework to understand."

"Rarely do you get the material prior to the review (like you should)."

"Packages arrived too close to CDR date to permit adequate review. Consequently questions could not be asked of contractor prior to the CDR."

Question 51:

"Updated drawings (in the proper format) and specifications were very late."

"Some of the data wasn't available until the day of the review."

"Reviewed material prior to CDR, but time limited contractor responses prior to CDR."

Question 52:

"Caused by Government due to lack of funding."

Question 54:

"This depends on many factors. It's the best way to learn about one's job."

"Not important: Can be a learning experience."

Question 55:

"PDR - Unknown."
"CDR - Specifications."

"CDR - Can't remember the manual my boss recommended."

"I have not found such guide."

"Reviewing the contractor's data packages are the most important guide for knowing what areas to focus on."

"PDR - a chairman who knows his job and has chaired several PDRs before (AF)."

"CDR - a chairman who knows his job and has chaired several CDRs before (AF)."

Questions 10-14:

"Represents activities which should occur before PDR. If you don't know the answers to these questions before you arrive at the PDR, you have no business being there."

General Comments:

"PDR and CDR review procedures and expected conduct need to be formally taught! We also need to put emphasis on meaningful participation and homework by those attending. Design reviews are serious business and a place for real work by involved people. Too often they are viewed as a source of TDY funding and free donuts for the masses."

Bibliography

1. Aeronautical Systems Division, Deputy for Engineering, ASD/EN SPO Engineer's Handbook. Wright-Patterson AFB OH:ASD/EN, September 1981.

2. Burt, David N. and William R. Soukup. "Purchasing's role in new product development," Harvard Business Review, 63, No5: 90-97 (September-October 1985).

3. Defense Systems Management College. System Engineering Management Guide. Contract number MDA 903-82-C-0339, Fort Belvoir Va: DSMC, 3 Octber 1983.

4. Department of the Air Force. Test and Evaluation. AFP 800-14. 26 September 1975.

5. Department of Defense. Military Standard Technical Reviews and Audits for Systems, Equipments, and Computer Programs. Mil Std 1521 (USAF), 1 June 1976.

6. Department of Defense. Transition from Development to Production. DoD 4245.7-M. February 1985.

7. Dinitto, Sammel A.,Jr. "Software Engineering Problems and Progress," Journal of Electronic Defense, 9, No8: 41, 42, 44, 46-50 (August 1986).

8. Garvin, David A. "Quality on the line," Harvard Business Review, 61, No5: 65-75 (September-October 1983).

9. HQUSAF Systems Command. A Guide for Program Management. AFSCP 800-3. 9 April 1976.

10. Kitagawa, Kenji. "Reliability-Program Case-History on Design Review," IEEE Transactions on Reliability, R-34, No3: 212-215 (August 1985).

11. Parnas, David Lorge and Clements, Paul C. "A Rational Design Process: How and Why to Fake It," IEEE Transactions on Software Engineering, SE-12, No2: 251-256 (February 1986).

12. President's Blue Ribbon Commission on Defense. A Quest for Excellence-Final Report to the President. June 1986.

13. R & D and New Products, Research Management, 25, No4: 16-22, (July 1982).

14. Steel, Robert. Class handouts distributed in ORSC 542, Management Behavior and Organizations, School of Systems and Logistics, Air Force Institute of Technology (AU), Wright-Patterson AFB OH, Jan-Mar 1987.

15. Systems 188 Introduction to Acquisition Management, Lecture material. School of Systems and Logistics, Air Force Institute of Technology (AU), Wright-Patterson AFB OH, 16 August 1983.

16. Webster, Francis M. "Tools for Managing Projects." Paper from Management Seminar: 1-11. The University of Michigan-Flint, 1986.

17. Walsch, Joseph P. "Auditing for project cost containment," Internal Auditor, 43, No2: 57-60 (April 1986).

VITA

Capt Rodney Bennett was born 9 October 1948 in St. Joseph MO. He graduated from Faucett High School, Faucett MO in 1967. From 1968 to 1972 he served in the US Air Force as a Flight Facilities Equipment Technician at Keesler AFB MS, Torrejon AB SP and Tinker AFB OK. From 1973 to 1977 he attended the University of Missouri at Kansas City and received a Bachelor of Science degree in Electrical Engineering in 1977. 1977 through 1979 he worked as an electrical engineer with Black and Veatch Consulting Engineers in Kansas City MO and St. Joseph Power and Light Company, St. Joseph MO. On 4 July 1979 he was commissioned into the US Air Force. 1979 through 1983 he was assigned to the Occupational, Envoronmental Health Lab at Brooks AFB TX as a Bioenvironmental Engineer. In 1981 he was registered in the Sstate of Texas as a Professional Engineer. 1983 he was reassigned to Wright Patterson AFB OH as a development engineer. In May 1986 he entered the Air Force Institute of Technology as a graduate student in Systems Management at the School of Systems and Logistics.

Permanent address: Box 306
Faucett MO 64448

UNCLASSIFIED

SECURITY CLASSIFICATION OF THIS PAGE

AD-A187 921

REPORT DOCUMENTATION PAGE

Form Approved OMB No. 0704-0188

1a. REPORT SECURITY CLASSIFICATION: UNCLASSIFIED	1b. RESTRICTIVE MARKINGS
2a. SECURITY CLASSIFICATION AUTHORITY	3. DISTRIBUTION/AVAILABILITY OF REPORT: Approved for public release; distribution unlimited.
2b. DECLASSIFICATION/DOWNGRADING SCHEDULE	
4. PERFORMING ORGANIZATION REPORT NUMBER(S): AFIT/GSM/LSY/87S-4	5. MONITORING ORGANIZATION REPORT NUMBER(S)
6a. NAME OF PERFORMING ORGANIZATION: School of Systems and Logistics; 6b. OFFICE SYMBOL (If applicable): AFIT/LSY	7a. NAME OF MONITORING ORGANIZATION
6c. ADDRESS (City, State, and ZIP Code): Air Force Institute of Technology (AU) Wright-Patterson AFB OH 45433-6583	7b. ADDRESS (City, State, and ZIP Code)
8a. NAME OF FUNDING/SPONSORING ORGANIZATION; 8b. OFFICE SYMBOL (If applicable)	9. PROCUREMENT INSTRUMENT IDENTIFICATION NUMBER
8c. ADDRESS (City, State, and ZIP Code)	10. SOURCE OF FUNDING NUMBERS: PROGRAM ELEMENT NO. / PROJECT NO. / TASK NO. / WORK UNIT ACCESSION NO.

11. TITLE (Include Security Classification): See Box 19

12. PERSONAL AUTHOR(S): Rodney G. Bennett, B.S., Capt, USAF

13a. TYPE OF REPORT	13b. TIME COVERED	14. DATE OF REPORT (Year, Month, Day)	15. PAGE COUNT
MS Thesis	FROM _____ TO _____	1987 September	132

16. SUPPLEMENTARY NOTATION

17. COSATI CODES			18. SUBJECT TERMS (Continue on reverse if necessary and identify by block number)
FIELD	GROUP	SUB-GROUP	Efficiency, System Engineering, Systems Management, Engineering Management
05	01		

19. ABSTRACT (Continue on reverse if necessary and identify by block number)

Title:
PRELIMINARY AND CRITICAL DESIGN REVIEW PROCEDURES AND EFFECTIVENESS

Thesis Advisor: Ronald W. Hitzelberger, Major, USAF
Instructor of Systems Management

Approved for public release: IAW AFR 190-1.
LYNN E. WELAVER 24 Sept 87
Dean for [illegible] Professional Development
Air Force Institute of Technology (AU)
Wright-Patterson AFB OH 45433

20. DISTRIBUTION/AVAILABILITY OF ABSTRACT	21. ABSTRACT SECURITY CLASSIFICATION
☒ UNCLASSIFIED/UNLIMITED ☐ SAME AS RPT. ☐ DTIC USERS	UNCLASSIFIED

22a. NAME OF RESPONSIBLE INDIVIDUAL	22b. TELEPHONE (Include Area Code)	22c. OFFICE SYMBOL
Ronald Hitzelberger, Major, USAF	513-255-3355	AFIT/LSY

DD Form 1473, JUN 86 — Previous editions are obsolete. — SECURITY CLASSIFICATION OF THIS PAGE

UNCLASSIFIED

BLOCK 19

This investigation examined the preparedness of Preliminary Design Review (PDR) and Critical Design Review (CDR) participants. Background and opinion data were gathered from junior and senior program managers and development engineers in order to assess their perception of PDR and CDR purposes, effectiveness/efficiencies, training and guidance.

The analysis was accomplished by sending a survey instrument to a sampling of program managers, and development engineers throughout the Air Force population within the boarders of the U.S.A.

The respondents tended to be in agreement with the PDR/CDR purposes stated in Mil Std 1521.

The analysis revealed that most PDR/CDRs are not as effective as they could be. The primary reason is the lack of knowledge on what should be accomplished by the participants.

Most respondents claimed self teaching as the method of learning their preparation for PDR/CDRs. Over 86.2 percent of all respondents felt initial training would be useful and the majority indicated 6 to 12 months of acquisition experience should be required before participating in a PDR/CDR. The most important guide for PDR/CDR preparation recommended by the respondents with previous PDR/CDR experience was the Mil Std 1521 and Defense System Management College (DSMC) System Engineering Management Guide.